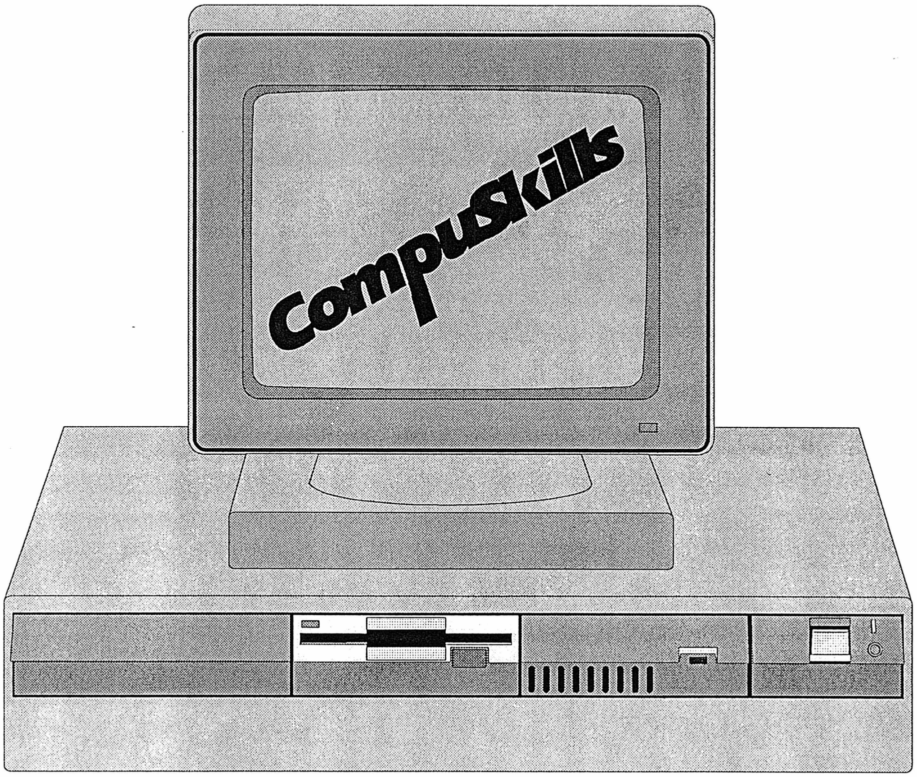
Beginning Personal Computers

CompuSkills
The Fast Track to Computer Literacy
PO Box 6326, Denver CO 80206 (303) 329-6666

(All rights reserved)

Beginning Personal Computers



CompuSkills

The Fast Track to Computer Literacy

PO Box 6326, Denver CO 80206 (303) 329-6666

(All rights reserved)

About CompuSkills

CompuSkills provides computer training, consulting, and support services to organizations of all sizes. We offer both classroom and on-site training courses, and special one-on-one consulting and support services.

All **CompuSkills** classroom-based courses provide each student with his/her own computer and training materials. The training materials are for the students' use both during the course and as a reference guide after the course has been completed.

Disclaimer

CompuSkills has taken every effort to insure the accuracy of this manual. If you should discover any discrepancies, please notify us immediately.

CompuSkills.
PO Box 6326
Denver CO 80206
(303) 329-6666

Objectives

By the end of this class, you will be able to:

- Name the parts of the personal computer
- Define the function of each component
- Understand how the computer works (in general terms)
- Launch Windows and navigate around the main groups
- Define the differences between the major types of applications
- Explain broadly how the computer processes data
- Name the parts of a DOS command
- Create simple DOS commands
- Move between directories and find files in them

Beginning Personal Computers

Contents

Section 1: Computer Hardware

Computer Hardware 1-1
System Unit 1-2
Rear of System Unit 1-3
Monitors 1-4
Keyboard 1-5
Mouse 1-7
Printers 1-8
Inside the System Unit 1-11
The Programmable Computer 1-12
How Memory and Microprocessor Work Together 1-13

Section 2: Typical Computer Applications

Windows 2-1
Word processing 2-3
Spreadsheets 2-5
Data bases 2-7
Communications 2-9
Graphics 2-11

Section 3: More on Hardware

Inside the System Unit 3-1
What really makes a computer go? 3-3
Internal Memory 3-4
Permenent Storage 3-6
Hard Disks 3-10
Monitors 3-11
Keyboard 3-12
Printers 3-13
Typical Price Sheet 3-15

Section 4: Introduction to DOS

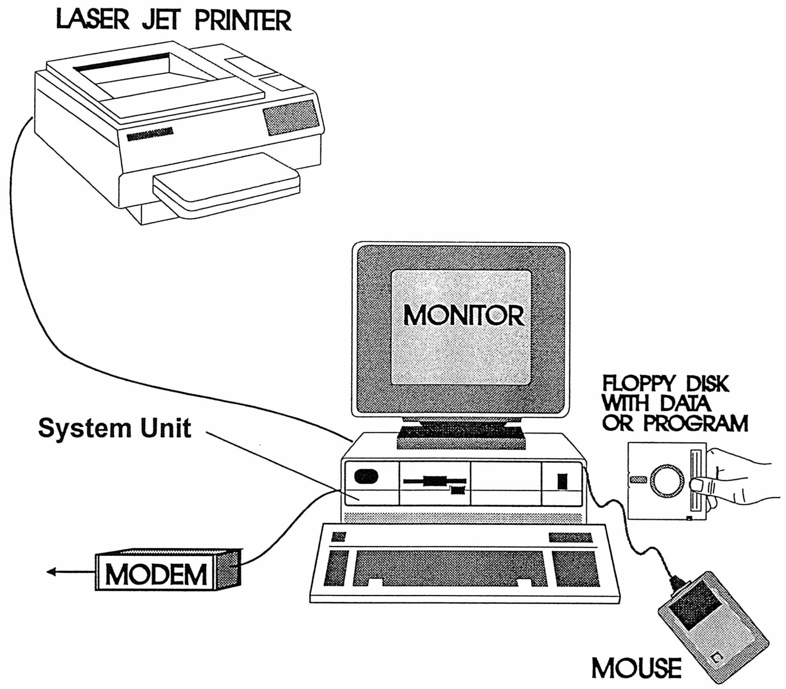
DOS 4-1
File-oriented commands 4-3
Disk-oriented commands 4-5

Section 5: Directories and DOS

Directories 5-1

Glossary

Section 1: Computer Hardware

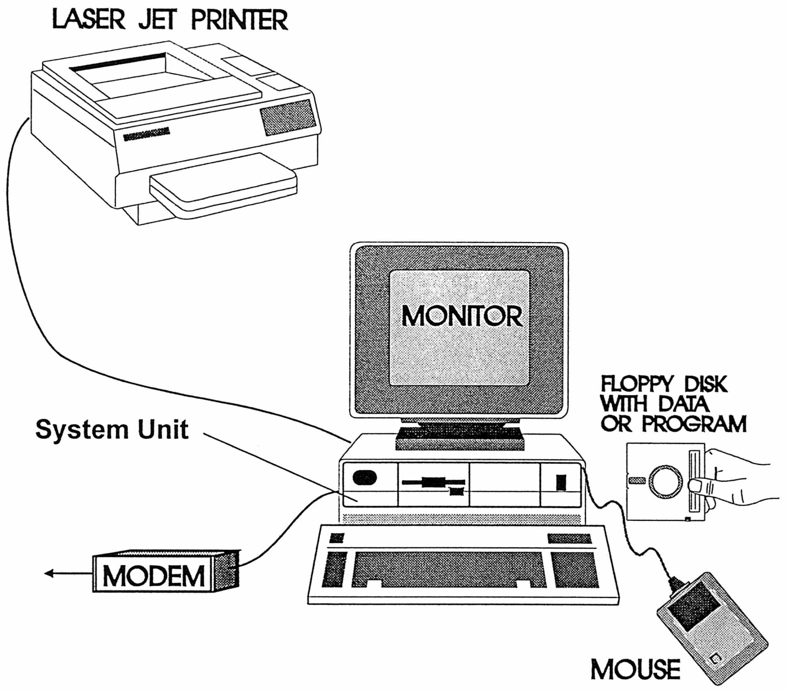


The personal computer consists of several parts:

- System unit—houses the computer's internals
- Monitor—the computer's way of keeping you informed about what's happening
- Keyboard—your way of controlling the computer and entering data
- Mouse—another way to control the computer by pointing at objects on the screen
- Printer—for getting paper copies of the results of your work

In the next few pages, we look at each component separately

Section 1: Computer Hardware

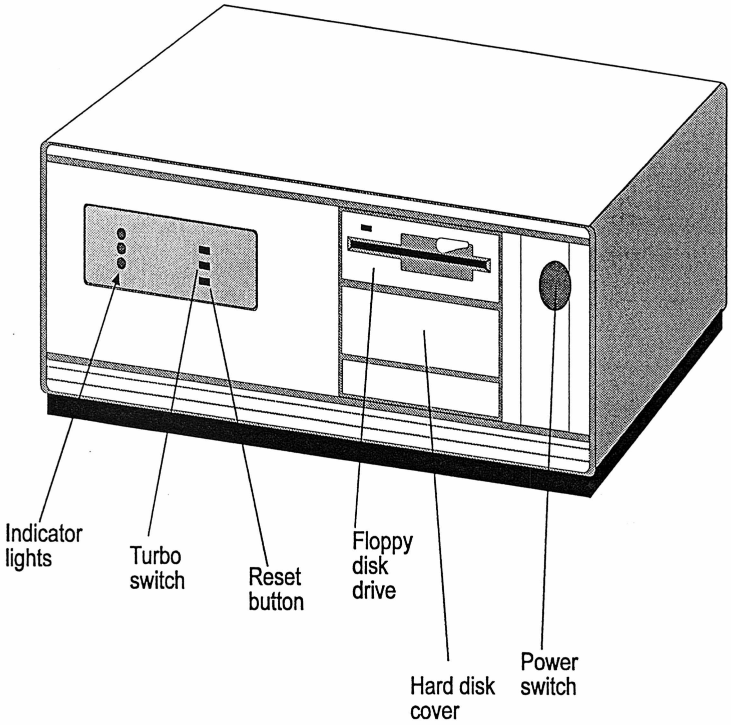


The personal computer consists of several parts:

- System unit—houses the computer's internals
- Monitor—the computer's way of keeping you informed about what's happening
- Keyboard—your way of controlling the computer and entering data
- Mouse—another way to control the computer by pointing at objects on the screen
- Printer—for getting paper copies of the results of your work

In the next few pages, we look at each component separately

The System Unit



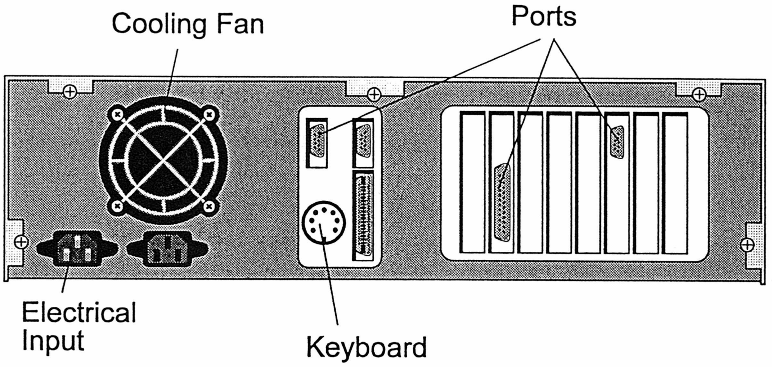
The System Unit houses the computer's internal components, including:

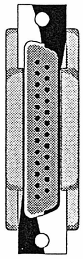
- Non-removable hard disk
- Floppy disk drive
- Electronic components (memory, microprocessor, etc)

Visible on the front are:

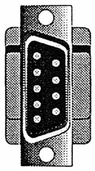
- Power switch
- Turbo switch (turn off to make the computer run more slowly for games)
- Reset button (in case the computer "freezes")
- Indicator lights for hard disk, turbo, and power

Rear of System Unit

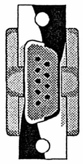




Parallel Port - Printer
(Female 25 pins)

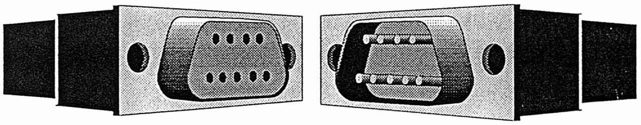


Serial Port - Mouse
(Male 9 pins)



Monitor Port
(Female 9 pin)

Match Male and Female of the same size



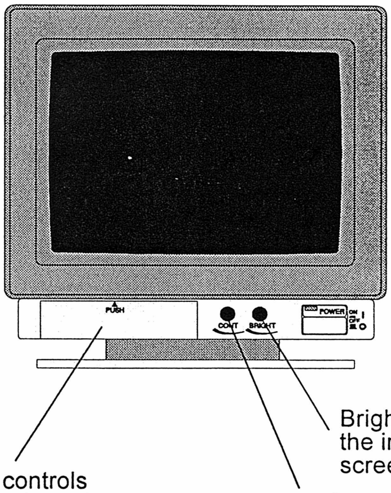
In addition to the power plug, at the back of the system unit are several different kinds of plugs (called **ports**) for getting data in and out of the computer:

- Video port (9 holes) for connecting the monitor
- Parallel port (25 holes) for connecting the printer
- Serial port (9 pins) for the mouse
- Phone jack (if you have a modem).

When hooking up cables, make sure that you connect male and female, and that the angles of the plugs match.

Monitor

The Monitor



Brightness controls the intensity of the screen

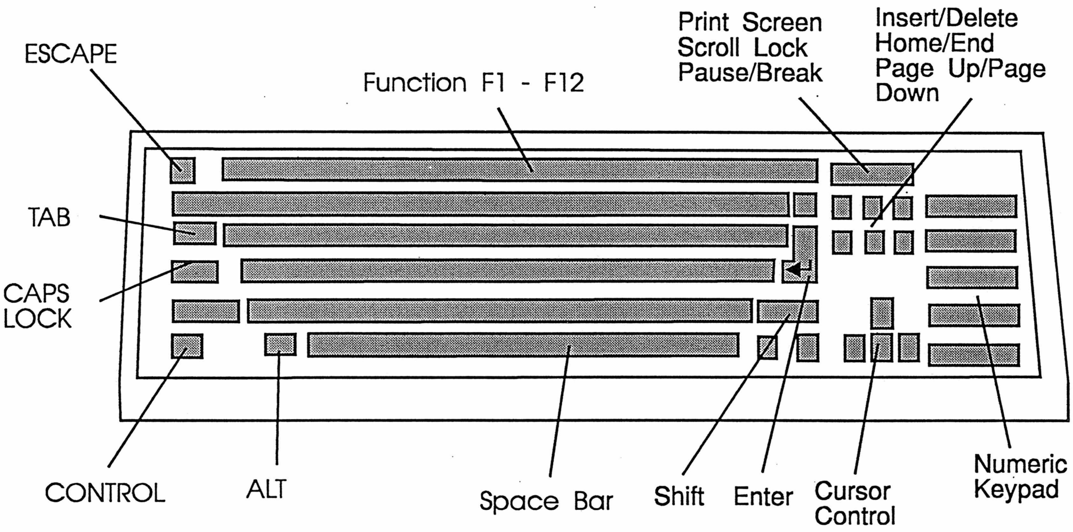
Other controls work with vertical and horizontal alignment, and picture size

Contrast controls the difference between black and white

When we monitor something, we keep an eye on it to see what's happening. The monitor is our window into the computer so that we can work with a document, spreadsheet, or data base without having to print it out each time.

Keyboard

The **keyboard** is your way of controlling what your computer does and entering data for the first time. It uses the old QWERTY keyboard of a hundred years ago, designed to slow fast typists down so that they couldn't jam the keys.



Additional Keys

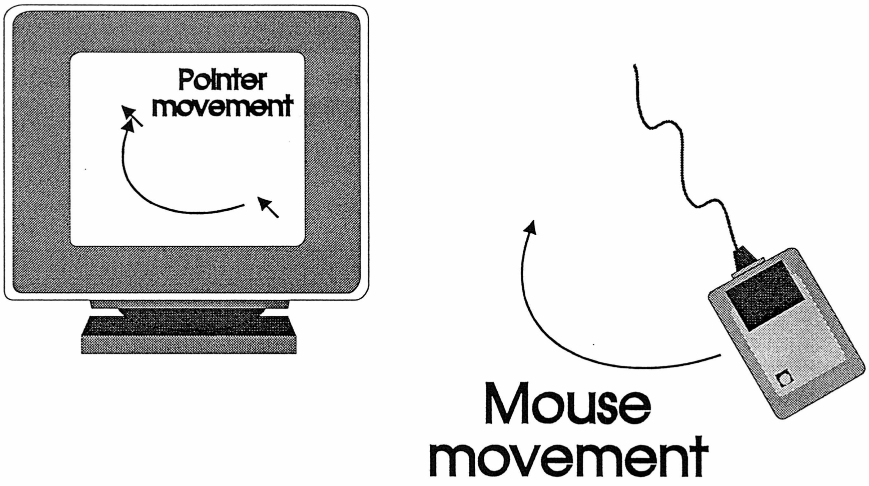
The modern computer keyboard has a few surprises for the typist, however. We'll return to these special keys later.

Mouse

A **mouse** allows you to control the movement of the screen cursor or pointer, and using the mouse buttons, to give basic commands to the program you're using. And with many graphics programs and programs with a graphical interface like WINDOWS, a mouse is essential.

Using a mouse

You move the mouse across a flat surface, and a piece of software called a **mouse driver** converts the movement of the ball inside the mouse into a measured distance on the screen (mechanical mice). Some mice work by detecting its movement over a grid of lines (optical mice). The mouse driver allows you set the sensitivity, or the ratio between the mouse movement and the screen pointer movement.



You use a mouse in many diferent ways:

- Pointing at things on the screen, like choices in a menu list or icons representing programs
- Generating graphics, like indicating the beginning and end of a line, or the center and radius of a circle
- Pointing to existing graphical elements and **dragging** them to a new location

Clicking

We don't always want the computer to react as we move the mouse pointer around on the screen. So, when we are pointing at the right object or item, we click on one of the buttons on top of the mouse. **Clicking** is a very important part of using a mouse because it tells the computer to execute some action, like the icon to which the mouse pointer is pointing. Or to move the selected object from one place to another.

Single and double clicking

Depending on the program and what you want to do, you may have to click the mouse button once or twice. With many programs, you can select an object or choice with a **single click**, and press the **ENTER key**. Alternatively, you can **double click** on the object or choice to tell the computer to immediately execute that operation.

Printers

Printers produce the hard copy version of your work to file, mail, or duplicate, and are responsible for an avalanche of paper as we move into the so-called "paperless era."

Because of their importance, the printer market is flooded with choices, and most are compatible with most computer systems (except for Apple/Macintosh whose printers are made specially for them).

Printer Types

Dot Matrix Printers

The **dot matrix** printer was all there was for many years. It's reliable, cheap, and robust, and produces legible output, especially when on the **near letter quality (NLQ)** setting.

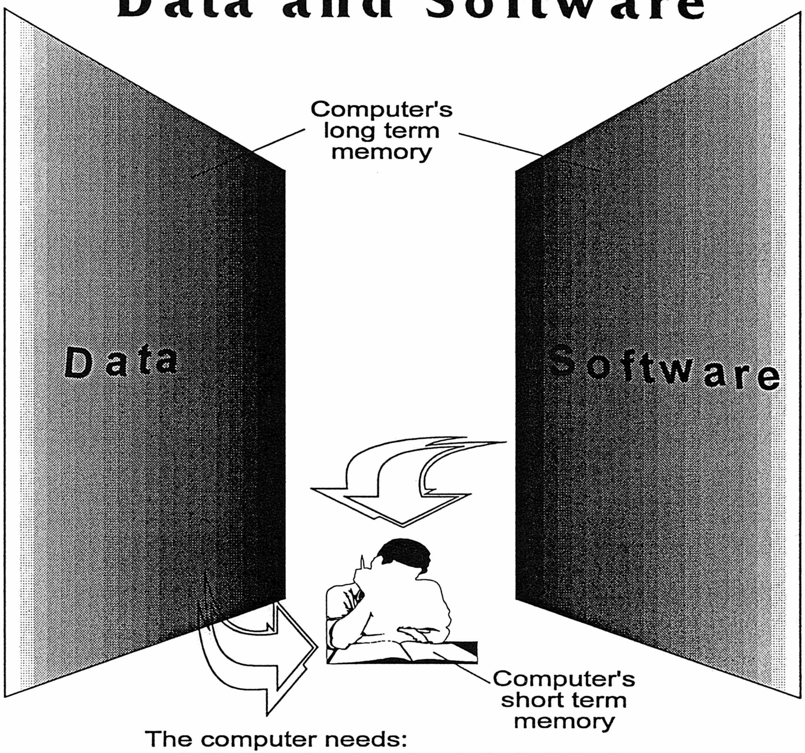
Laser Jet Printers

High quality, fast, silent, and affordable, **laser jet** printers have revolutionized personal computing almost as much as the computer itself. Under the control of output from the computer, a laser beam etches the required image on a drum which directs how the printer transfers powdered ink on to the paper. Because the laser can be controlled very precisely (300 dots per inch, or dpm), the printer can produce **near typeset quality** and incredible graphics.

Inside the System Unit

Before we look inside the system unit, we must know a little about how a computer works. The two main elements are **data** and **software**.

Data and Software



The computer needs:
1. The Know-how to perform tasks (called software programs)
2. The data to perform them on

Software is the set of instructions that tell the computer how to perform calculations, spell check documents, draw pictures from data we give it.

Data is the raw input we give the computer, such as text and numbers, and lines and shapes we draw. The computer uses the "know-how" of the software to process the data to give us the results we want.

If you go to a library to perform some task, you would need know-how and data. So you get a book out of the "know-how section" and a book out of the "data" section, and put them on your desk. When you finish the task, you put the books back on the shelves and take down the data and know-how books for the next task. This way, you can perform **any** task for which a know-how book has been written.

The computer's **hard disk** represents the library shelves with data and know-how, and the computer's **memory** represents the desk. Your brain is represented by the **microprocessor**. And it can perform whatever task for which you can give it instructions via software.

The Programmable Computer

The secret of the computer's flexibility is its **microprocessor** and **internal memory**.

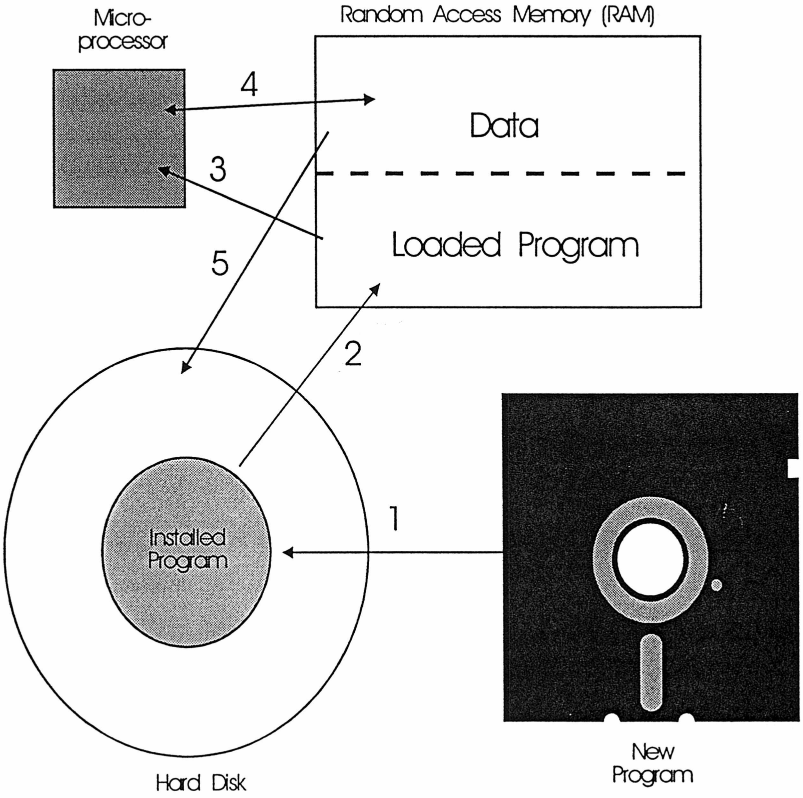
1. Load a word processing program from the hard disk to the computer's memory, then the computer is a word processing machine. Once the program is loaded into memory, it begins to drive the computer's "brain," the **microprocessor,** to do just word processing functions.

2. Next, you load a spreadsheet program into memory and the computer becomes a spreadsheet machine, and so on.

The microprocessor is controlled by the program in memory, and works on the data you type in to create your document, spreadsheet, data base or diagram.

Because the data is held in the computer's short term memory, you can change it any way you wish. Of course, if the power goes off before you make a permanent copy, **your work will be lost**! You save your work to the permanent hard disk or a floppy by giving it a "file-name" Saving your work is the most important thing to remember about computers, and we'll return to this later.

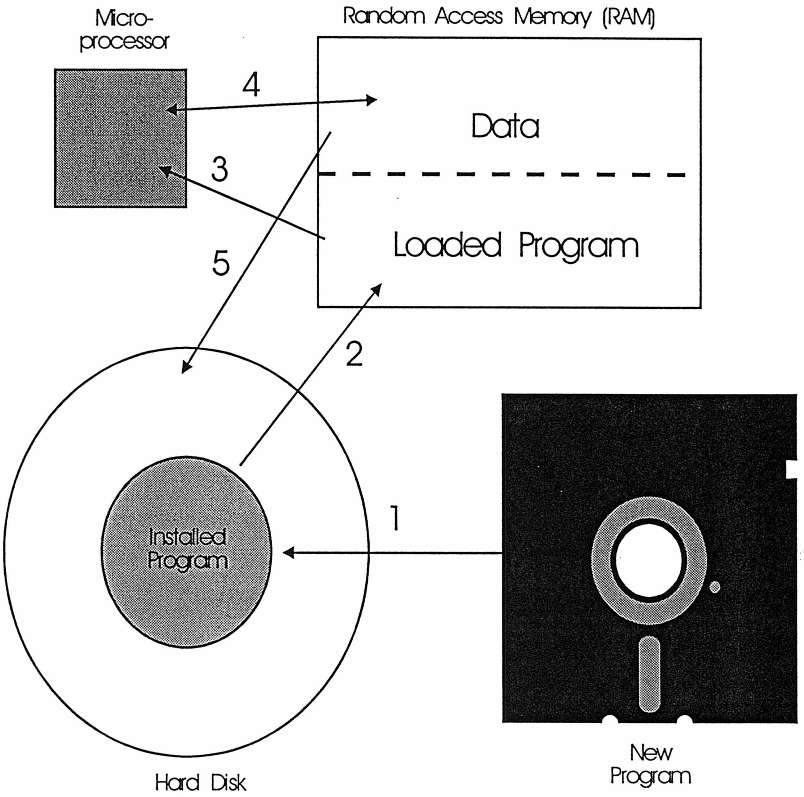
Once you've saved your work to the hard disk or floppy disk, you can turn the computer off. Later, if you want to resume working on the data, you "open the file" again, and continue working on it as often and as much as you like. In fact, this is the usual way of using computers.



How Memory and Microprocessor Work Together

The processor consists of four main parts:

- **Random Access Memory** for holding the program currently being executed
- **Microprocessor** for executing the program to manipulate data
- **Hard Disk** for holding permanent copies of programs and data
- **Floppy Disk Drive** for getting programs and data in and out of the computer



The steps in executing a program are:

1. You **install** a new program from one or more floppy disks on to your hard disk = long-term storage. (This is done only once.)

2. You **load** the installed program into memory. (This must be done each time you want to use the program.)

3. The loaded program controls what the microprocessor does by giving it know-how instructions.

4. You enter data from the keyboard. The program stores your data in memory and displays it on the monitor. At this point, your data is at risk from power failure or program error.

5. You save your data permanently on hard disk or floppy disk.

Self Test

1. Every computer must have the following in order to work (check all that apply)

☐ Monitor
☐ Keyboard
☐ Floppy disk drive
☐ Mouse
☐ Modem
☐ Electricity
☐ System Unit
☐ Printer
☐ Software

2. We use a mouse for (check all that apply):

☐ Pointing to screen objects
☐ Exercising the cat
☐ Starting programs

3. Software is (select one):

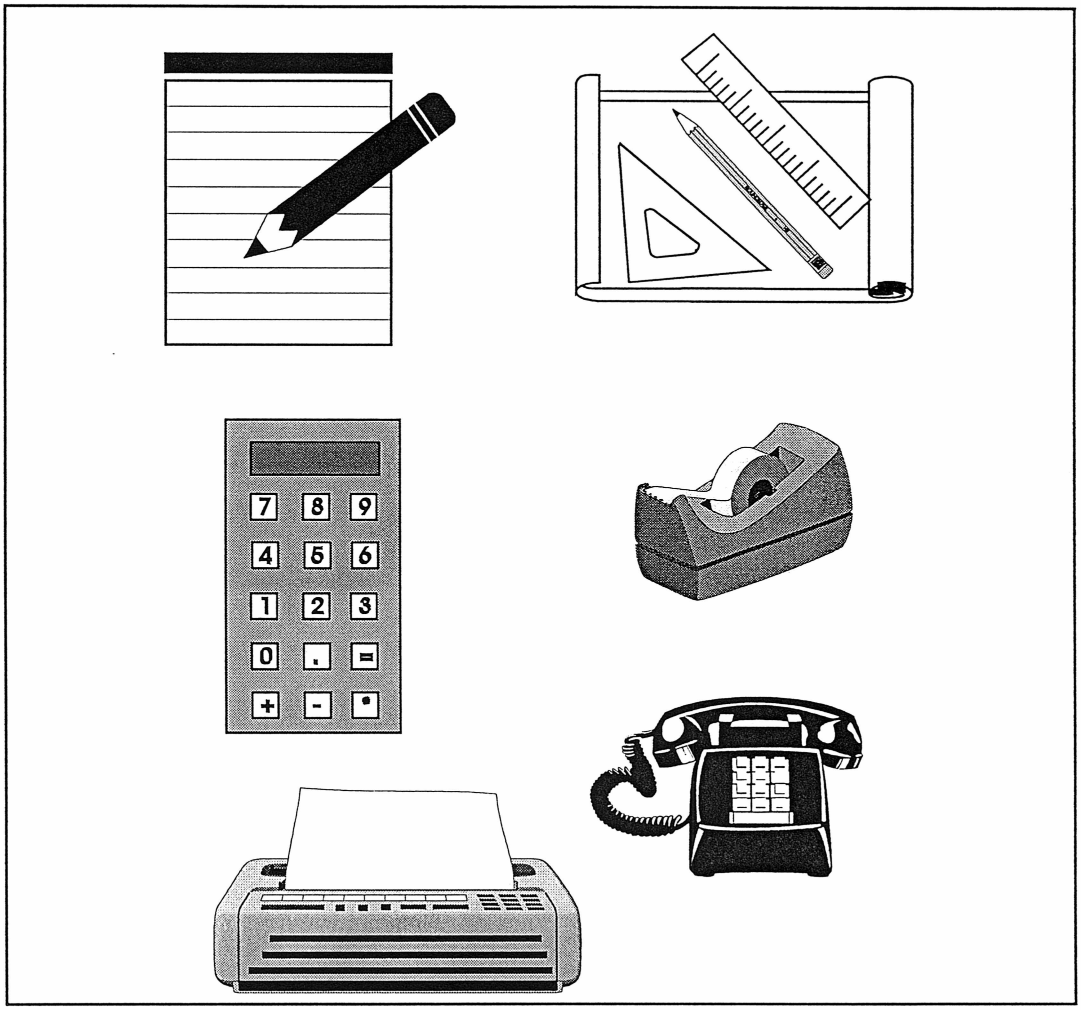
☐ The place where data is held
☐ Instructions that drive the computer
☐ The computer's "brain"

Section 2: Typical Computer Applications

Typical Desk Top

Look at the desk in the typical office, and you may see a collection of items including a typewriter, a calculator, a list pad or rolodex file, a telephone, and a pencil and ruler. These items allow us to perform five vital functions:

- Text handling to produce letters, reports, and so on
- Numerical work on rows and columns of figures
- Storage and retrieval of information for mailing lists, inventories, clients, and so on
- Communication with the outside world for receiving and sending information
- Graphical work like drawings and maps.



Not only does the computer perform all these tasks, it performs them much better than the original devices. Depending on the program we are running at any time, the computer is a superior typewriter, calculator, rolodex, telephone, and drawing instrument. We can switch between the functions very quickly, and the functions exchange data between themselves.

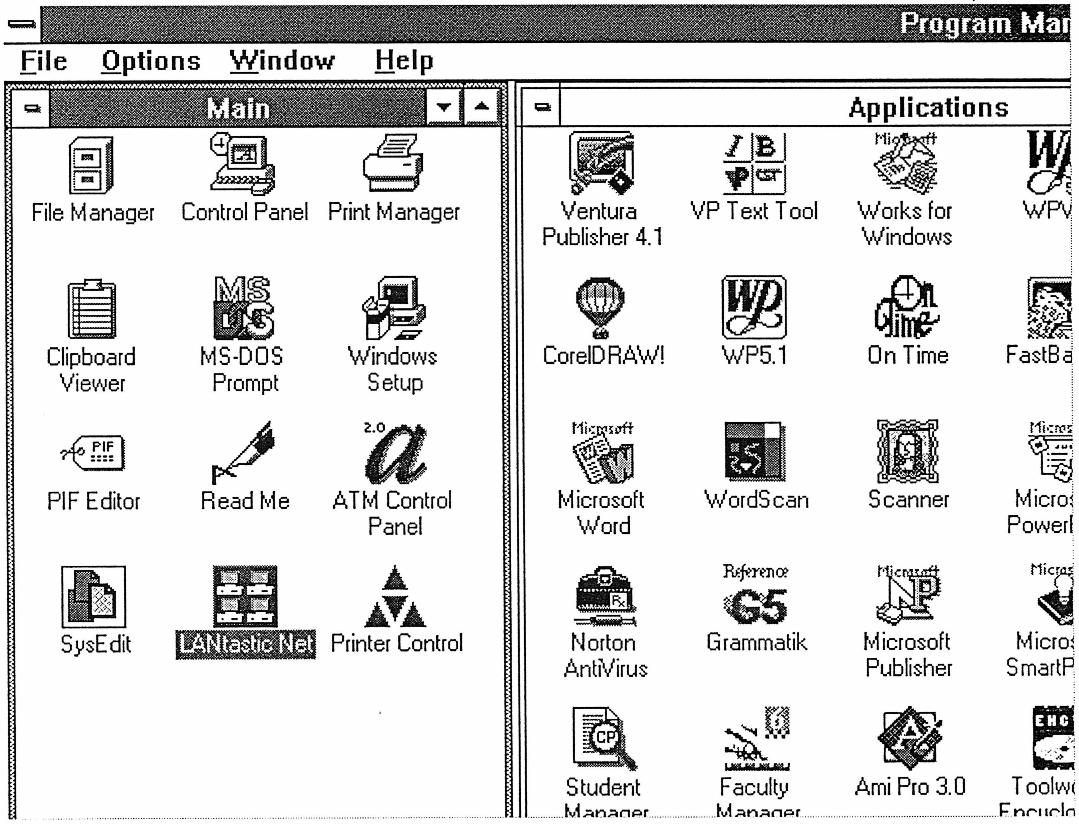
Windows

Microsoft **Windows** is designed to support the way we work, with several jobs in progress at any one time. Windows also simulates a desktop in which we can see all the tools at our disposal and begin using one or more tools just by clicking on icons that represent them.

Windows is:

- A Graphical User Interface that is extremely easy and intuitive to use.
- Consistent because applications programs for Windows have a certain appearance and design, so things are done consistently within different programs. Whether you're running a word processor, a spreadsheet, or a database, the basic techniques for performing tasks (such as opening, closing, and printing files) are the same. And because of the keyboard and mouse consistency, once you learn the basics, you don't have to search through manuals for commands.
- Multi-tasking because you can load multiple applications simultaneously and switch between them, and even run multiple applications at the same time and move quickly from one program to another.
- Windows also allows you to move information from one application to another via a "clipboard."

The heart of Windows is the Program Manager that gives access to programs via a number of windows on the screen.



Program Manager

The Program Manager screen is usually configured to show:

- **Main window**, with icons for computer-oriented support programs, like File Manager, Print Manager, Set up, and Control. Pointing to an icon and double-clicking brings up the appropriate program and its dialog screen. We use these utility programs to control things like how much memory gets allocated to what, and to tell Windows about our computer and peripherals, such as how much memory is in our laser jet printer

- **Accessories window**, with icons for a range of user-oriented support programs, such as Write (a primitive word processor), Paintbrush (a powerful graphics paint program), and an on-screen calendar, calculator, cardfile, and clock.

- **Windows Applications**, with icons for application programs that have been specially written to use the Windows environment

- **Non-Windows Applications**, with icons for applications that have not been specially written for Windows but can be started from Windows as a convenience.

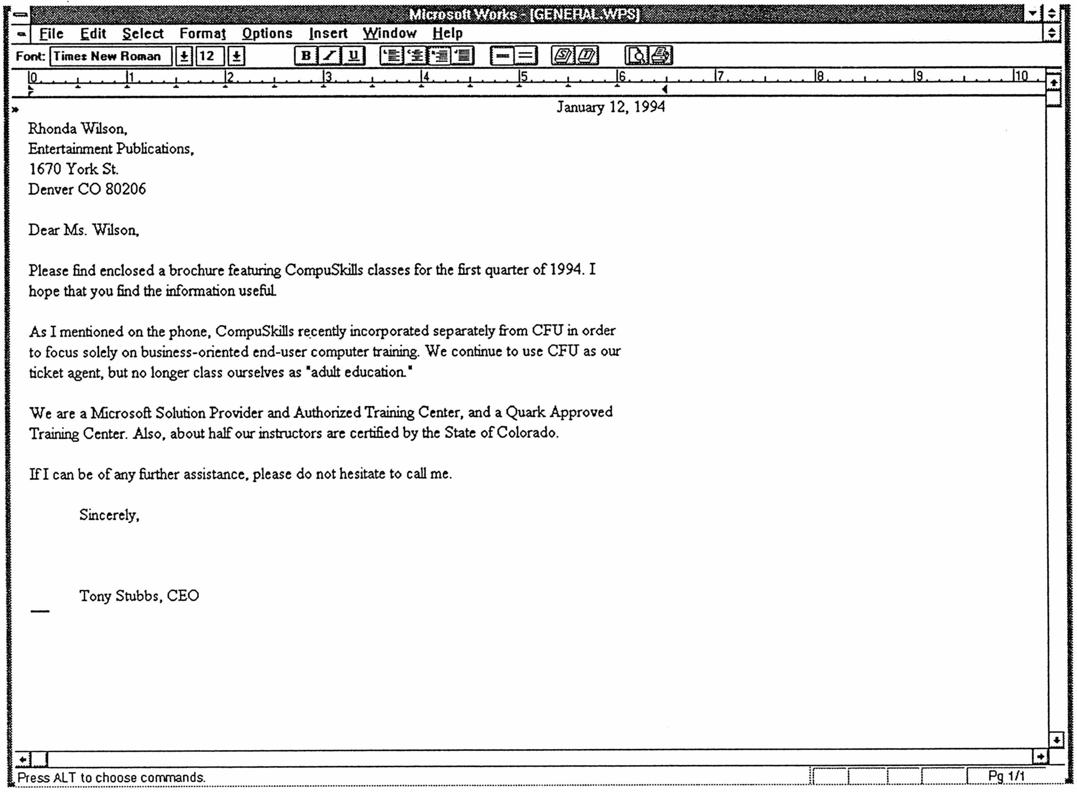
Icons

With an icon-based system, each program is represented by a small picture. We invoke a program by pointing at it with the mouse pointer, and clicking the left mouse button twice. We **must** use a mouse because there is no other way to point to something in the center of the screen.

Word Processing

Run a **word processing** program and your computer is a powerful text editor. You can:

- Enter and edit text on the screen
- Change words, sentences and paragraphs
- Move them, insert them, and delete them, all with just a few key strokes
- If you're stuck for a word, look it up in an electronic thesaurus
- Check your spelling against the electronic dictionary
- Run a grammar program that will analyze your writing style and make recommendations for improvement.
- Print your document on a printer that gives you perfect original copies each time
- If you are writing a letter to several different people, you can pull their names and addresses from your electronic list or rolodex, and produce an original for each person.


Microsoft Works - [GENERAL.WPS]
File Edit Select Format Options Insert Window Help
Font: Times New Roman
12
B I U
Press ALT to choose commands.
Pg 1/1

January 12, 1994

Rhonda Wilson,
Entertainment Publications,
1670 York St.
Denver CO 80206

Dear Ms. Wilson,

Please find enclosed a brochure featuring CompuSkills classes for the first quarter of 1994. I hope that you find the information useful.

As I mentioned on the phone, CompuSkills recently incorporated separately from CFU in order to focus solely on business-oriented end-user computer training. We continue to use CFU as our ticket agent, but no longer class ourselves as "adult education."

We are a Microsoft Solution Provider and Authorized Training Center, and a Quark Approved Training Center. Also, about half our instructors are certified by the State of Colorado.

If I can be of any further assistance, please do not hesitate to call me.

Sincerely,

Tony Stubbs, CEO

You can even turn your computer into a **desktop publishing** machine and create a professional page layout with graphics, logos, and different **type faces** and **fonts**:

`The quick brown fox jumped over the lazy dog (Courier)`

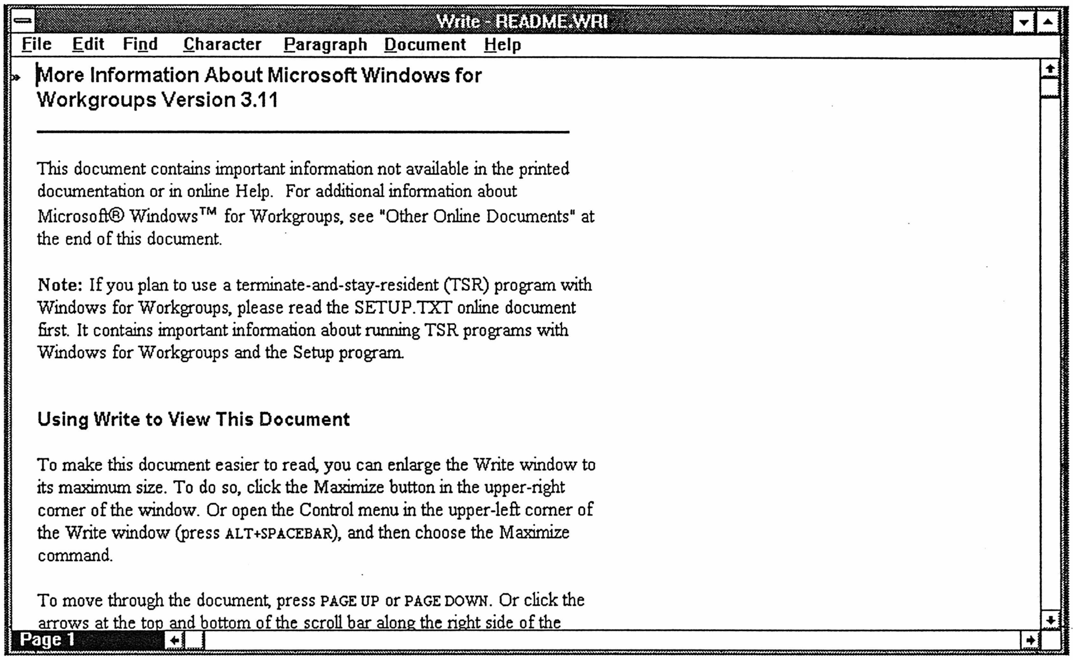
The quick brown fox jumped over the lazy dog (Helvetica)

Word Processing Exercise

1. In the Accessories group, double-click on the icon for Write

2. Click on File on the menu bar

3. Click on Open and select README.WRI



More Information About Microsoft Windows for Workgroups Version 3.11

This document contains important information not available in the printed documentation or in online Help. For additional information about Microsoft® Windows™ for Workgroups, see "Other Online Documents" at the end of this document.

Note: If you plan to use a terminate-and-stay-resident (TSR) program with Windows for Workgroups, please read the SETUP.TXT online document first. It contains important information about running TSR programs with Windows for Workgroups and the Setup program.

Using Write to View This Document

To make this document easier to read, you can enlarge the Write window to its maximum size. To do so, click the Maximize button in the upper-right corner of the window. Or open the Control menu in the upper-left corner of the Write window (press ALT+SPACEBAR), and then choose the Maximize command.

To move through the document, press PAGE UP or PAGE DOWN. Or click the arrows at the top and bottom of the scroll bar along the right side of the

4. Practice editing the document.
- Highlight some text by dragging the mouse across it and change the font size using Character...Larger
- Use Character...Bold to make the text bold
- Use Character...Font to change the typeface. Notice the effect on the screen
- Click anywhere in a paragraph and center the text using Paragraph...Center

5. Quit Write using File...Exit. Click NO to the question Save Changes?

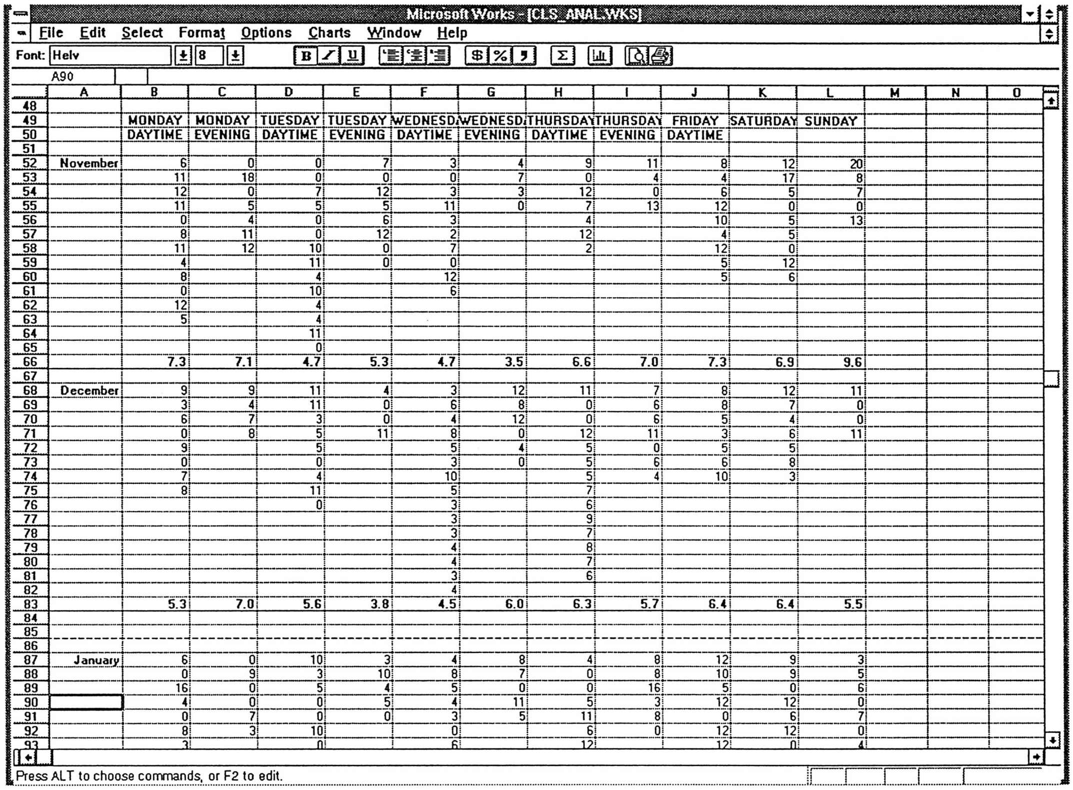
Spreadsheets

Load a **spreadsheet** program and you have a powerful financial tool in your hands. A spreadsheet is a collection of **cells** organized by rows and columns to contain data:

	Column A	Column B	Column C	Column D	Column E
Row 1	cell A1	cell B1	cell C1	cell D1	cell E1
Row 2	cell A2	cell B2	cell C2	cell D2	cell E2
Row 3	cell A3	cell B3	cell C3	cell D3	cell E3

Using a spreadsheet program, you can:

- Enter numbers by row or column to create a new spreadsheet
- Edit numbers in an existing spreadsheet, insert new numbers, and delete them
- Get a total of figures, perform a function like square root, or put a short formula in the spreadsheet. The program will display the result of the formula (see following chart). Change a number and the computer will recalculate the result for you.
- Sort the entries however you want, and perhaps extract only entries with certain values
- Make bar charts and pie charts from the values in your spreadsheet
- Make a spreadsheet available to the word processing program.


Microsoft Works - [CLS_ANAL.WKS]
File Edit Select Format Options Charts Window Help

Font: Helv 8

A90

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
48															
49		MONDAY	MONDAY	TUESDAY	TUESDAY	WEDNESD/	WEDNESD/	THURSDAY	THURSDAY	FRIDAY	SATURDAY	SUNDAY			
50		DAYTIME	EVENING	DAYTIME	EVENING	DAYTIME	EVENING	DAYTIME	EVENING	DAYTIME					
51															
52	November	6	0	0	7	3	4	9	11	8	12	20			
53		11	18	0	0	0	7	0	4	4	17	8			
54		12	0	7	12	3	3	12	0	6	5	7			
55		11	5	5	5	11	0	7	13	12	0	0			
56		0	4	0	6	3		4		10	5	13			
57		8	11	0	12	2		12		4	5				
58		11	12	10	0	7		2		12	0				
59		4		11	0	0				5	12				
60		8		4		12				5	6				
61		0		10		6									
62		12		4											
63		5		4											
64				11											
65				0											
66		7.3	7.1	4.7	5.3	4.7	3.5	6.6	7.0	7.3	6.9	9.6			
67															
68	December	9	9	11	4	3	12	11	7	8	12	11			
69		3	4	11	0	6	8	0	6	8	7	0			
70		6	7	3	0	4	12	0	6	5	4	0			
71		0	8	5	11	8	0	12	11	3	6	11			
72		9		5		5	4	5	0	5	5				
73		0		0		3	0	5	6	6	8				
74		7		4		10		5	4	10	3				
75		8		11		5		7							
76				0		3		6							
77						3		9							
78						3		7							
79						4		8							
80						4		7							
81						3		6							
82						4									
83		5.3	7.0	5.6	3.8	4.5	6.0	6.3	5.7	6.4	6.4	5.5			
84															
85															
86															
87	January	6	0	10	3	4	8	4	8	12	9	3			
88		0	9	3	10	8	7	0	8	10	9	5			
89		16	0	5	4	5	0	0	16	5	0	6			
90		4	0	0	5	4	11	5	3	12	12	0			
91		0	7	0	0	3	5	11	8	0	6	7			
92		8	3	10		0		6	0	12	12	0			
93		3		0		6		12		12	0	4			

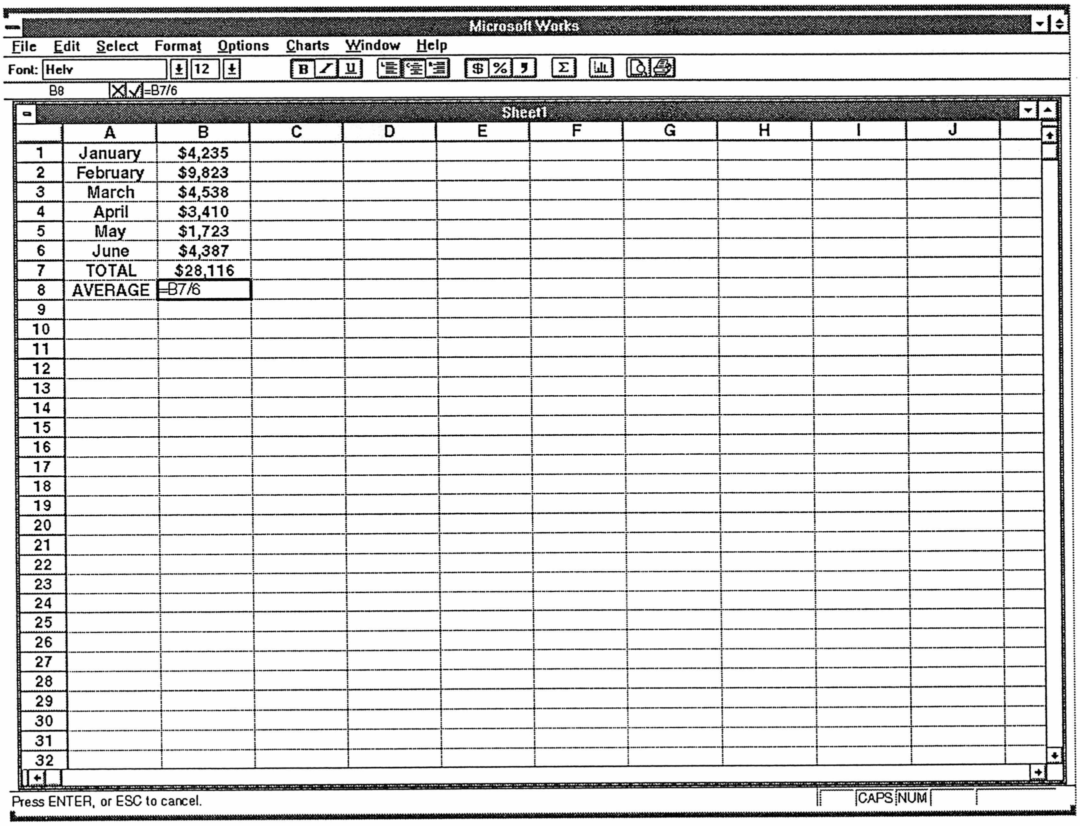
Press ALT to choose commands, or F2 to edit.

Formulas

The real power of a spreadsheet program is that you can put a formula in a cell which involves the values in other cells. The program will perform the math automatically and put the result in the cell containing the formula. For example, in the following spreadsheet:

- Type "January" into cell A1 and use Edit...Fill Series to add five more months
- Enter the numbers into cells B1 though B6 and use Format...Currency to convert the numbers into dollars. Type "0" for the number of decimals.
- Type "=SUM(B1..B6)" in cell B7 means "add the numbers in cells B1 through B6 together and display the sum in cell B7." When you press Enter, the formula is replaced by the result of the calculation.
- Type "=B7/6" in cell B8 means "divide the value in cell B7 by 6 and display the result in cell B8." When you press Enter, the formula is replaced by the result of the calculation.

	COLUMN A	COLUMN B	COLUMN B DISPLAY
Row		Enter this:	To get this:
1	January	4235	$4,235
2	February	9823	$9,823
3	March	4538	$4,538
4	April	3410	$3,410
5	May	1723	$1,723
6	June	4387	$4,387
7	TOTAL	=SUM(B1..B6)	$28,116
8	AVERAGE	=B7/6	$4,686



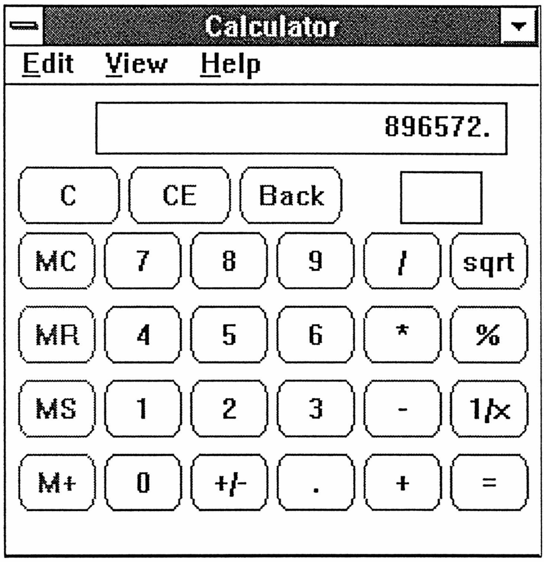
B8 =B7/6

	A	B
1	January	$4,235
2	February	$9,823
3	March	$4,538
4	April	$3,410
5	May	$1,723
6	June	$4,387
7	TOTAL	$28,116
8	AVERAGE	=B7/6

Press ENTER, or ESC to cancel.

Calculator Exercise

1. Click on the Calculator icon in the Accessories group



2. Click on View...Standard if your calculator does not look like this

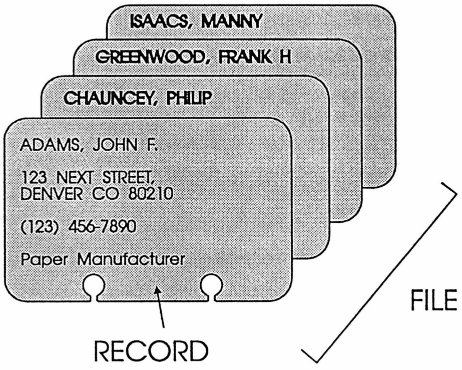
3. Point to some numbers and click the left mouse button

4. Click on SQRT

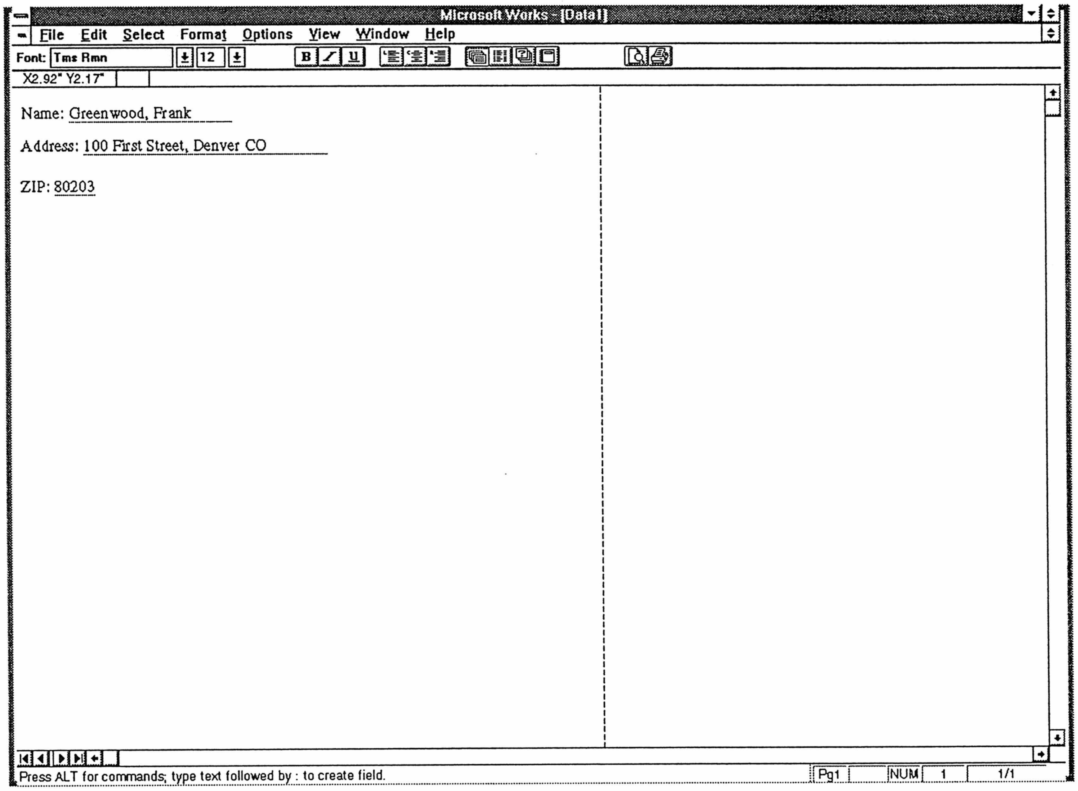
5. Click on the small box at the top left corner, and choose Close.

Data Bases

A **data base** is a collection of data, organized in some meaningful way. Load a **data base** program and you have a powerful information manager in your hands.



Data base programs use the idea of **records** within **files**. A **record** is a collection of pieces of information about a specific person, place, or thing. With a rolodex, we use a different card for each subject, person, place, or item. A data base program uses a separate **record**, but a record can be very large, and hold hundreds of pieces of information about each person or thing.


Microsoft Works - [Data1]
File Edit Select Format Options View Window Help
Font: Tms Rmn 12
X2.92" Y2.17"
Pg1 NUM 1 1/1

Name: Greenwood, Frank

Address: 100 First Street, Denver CO

ZIP: 80203

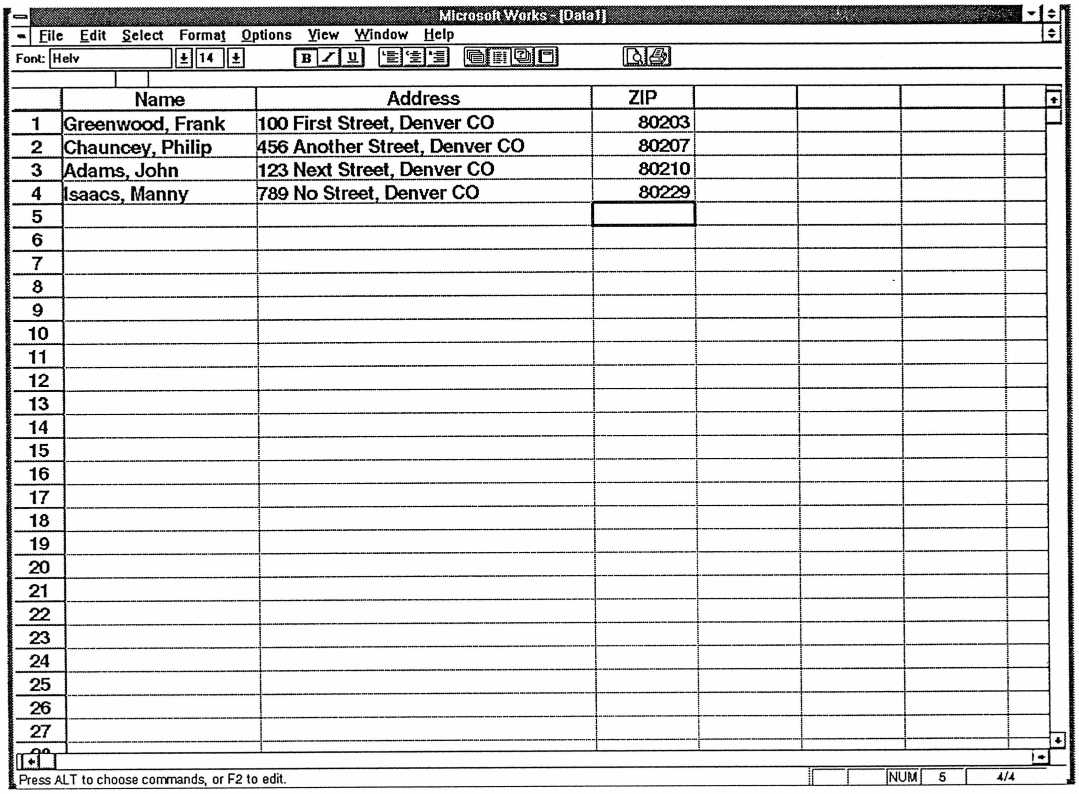
Press ALT for commands; type text followed by : to create field.

With a data base program, we can:

- Add, change, and delete records very easily
- When we add a record out of sequence, the computer will quickly sort all the records back into sequence.

If we have a client list sorted by name, the computer can sort it to ZIP code sequence, select only certain ZIP codes, and give these to the word processing program to generate letters to those clients:

NAME	ADDRESS	ZIP
Greenwood, Frank	100 First Street, Denver CO	80203
Chauncey, Philip	456 Another Street, Denver CO	80207
Adams, John	123 Next Street, Denver CO	80210
Isaacs, Manny	789 No Street, Denver CO	80229
...	...	...

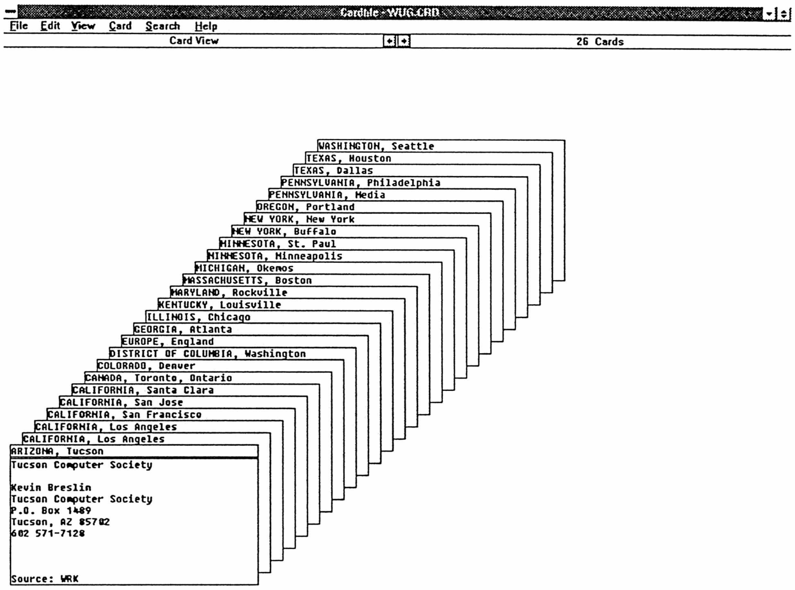

Microsoft Works - [Data1]
File Edit Select Format Options View Window Help
Font: Helv
14
B I U
NUM 5 4/4

	Name	Address	ZIP
1	Greenwood, Frank	100 First Street, Denver CO	80203
2	Chauncey, Philip	456 Another Street, Denver CO	80207
3	Adams, John	123 Next Street, Denver CO	80210
4	Isaacs, Manny	789 No Street, Denver CO	80229
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			
25			
26			
27			

Press ALT to choose commands, or F2 to edit.

CardFile Exercise

The Windows Cardfile is like an electronic Rolodex. We can add new cards, sort them, search for particular cards, and print the cards out. The following lists Windows User Groups.



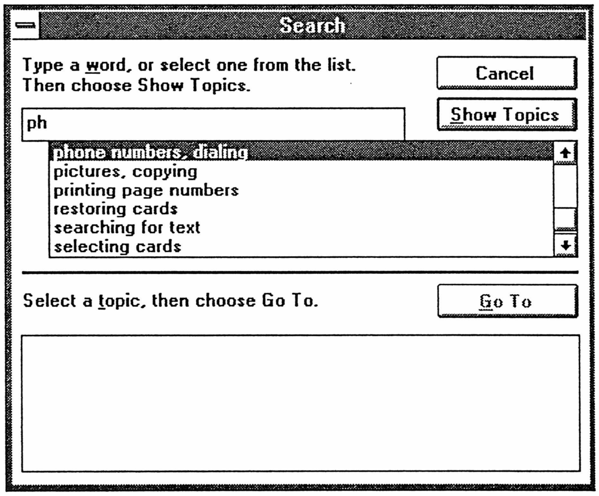
WASHINGTON, Seattle
TEXAS, Houston
TEXAS, Dallas
PENNSYLVANIA, Philadelphia
PENNSYLVANIA, Media
OREGON, Portland
NEW YORK, New York
NEW YORK, Buffalo
MINNESOTA, St. Paul
MINNESOTA, Minneapolis
MICHIGAN, Okemos
MASSACHUSETTS, Boston
MARYLAND, Rockville
KENTUCKY, Louisville
ILLINOIS, Chicago
GEORGIA, Atlanta
EUROPE, England
DISTRICT OF COLUMBIA, Washington
COLORADO, Denver
CANADA, Toronto, Ontario
CALIFORNIA, Santa Clara
CALIFORNIA, San Jose
CALIFORNIA, San Francisco
CALIFORNIA, Los Angeles
CALIFORNIA, Los Angeles
ARIZONA, Tucson

Tucson Computer Society

Kevin Breslin
Tucson Computer Society
P.O. Box 1489
Tucson, AZ 85702
602 571-7128

Source: WRK

1. Open the Cardfile by clicking on its icon in the Accessories group
2. Open an existing card file using File...Open and selecting WUG.CRD
3. Switch between Card View and List View using View Menu...Card & List
4. Select a user group card by clicking in its index line
5. Use Cardfile Help to find out how to get Windows to dial a number on a card. (Hint: use "Search for Help On" and type "ph" in the search box. Then click "Go To."



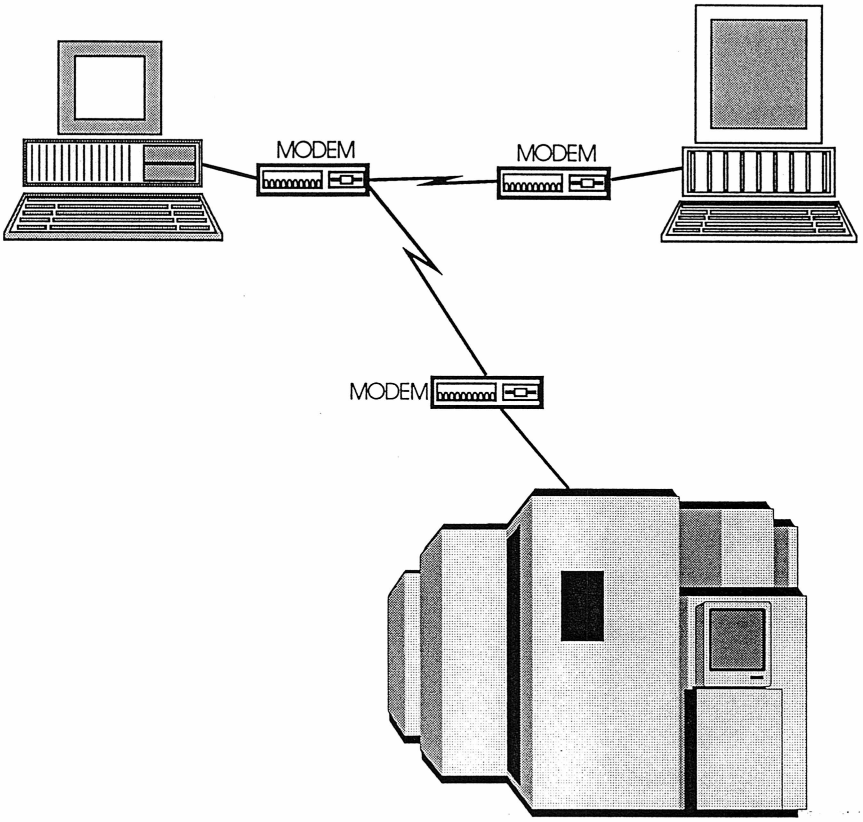
Type a word, or select one from the list.
Then choose Show Topics.

ph

phone numbers, dialing
pictures, copying
printing page numbers
restoring cards
searching for text
selecting cards

Select a topic, then choose Go To.

Communication



Remote Mainframe Computer

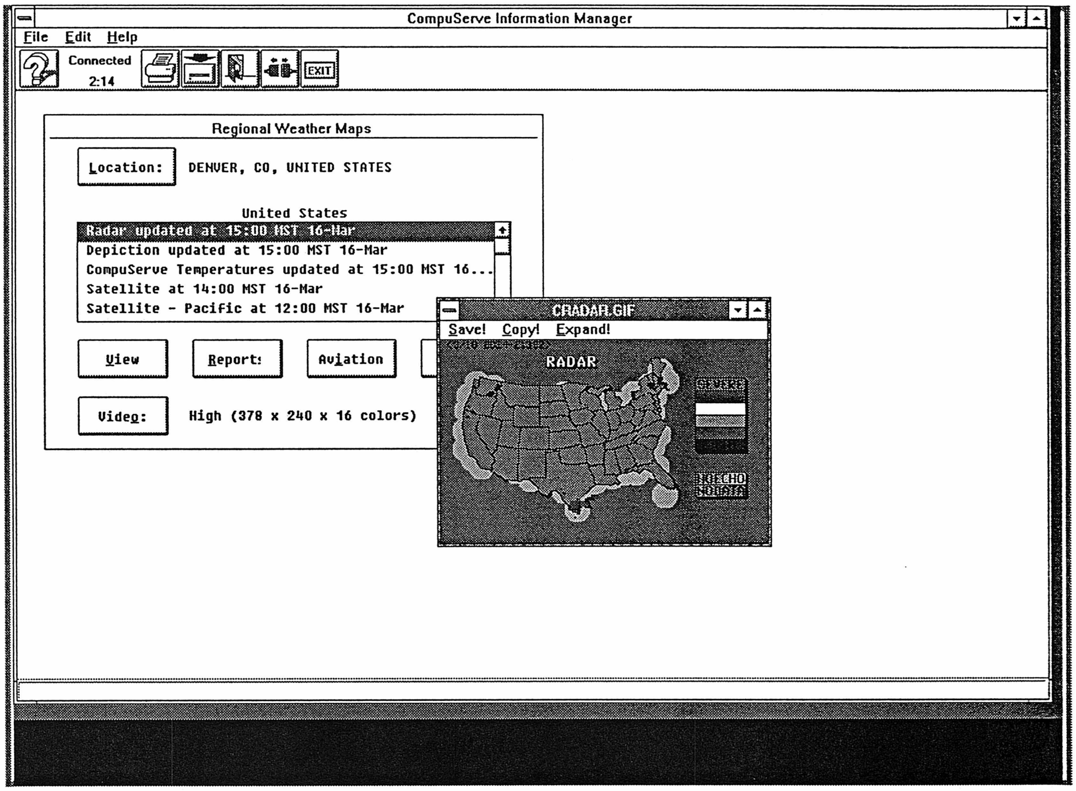
Computers can transmit data to, and receive data from, other computers via telephone lines.

If we have a spreadsheet, data base, or document in our computer, we can print it out and mail it or fax it to someone else. But that takes time, and the other person may have to re-enter the information into their computer in order to use it. But if we have a special box of electronics (called a **modem** for **mod**ulator/**dem**odulator) we can send them the file so that it ends up in their machine exactly as it left our computer. They can work with it and send it back to us, or they can print it themselves.

Our modem converts our computer's internal data format into a format that can go over telephone lines. Then a modem at the other end converts the telephone format back into computer format.

Another major use for a modem is to hook up to online services such as CompuServe, Americal Online, and Prodigy, to local bulletin boards, and to the global network called the Internet.

The diagram below shows a weather map displayed by CompuServe. We can copy the map to a hard disk, or display it full screen for more detail.



Location: DENVER, CO, UNITED STATES

United States
Radar updated at 15:00 MST 16-Mar
Depiction updated at 15:00 MST 16-Mar
CompuServe Temperatures updated at 15:00 MST 16...
Satellite at 14:00 MST 16-Mar
Satellite - Pacific at 12:00 MST 16-Mar

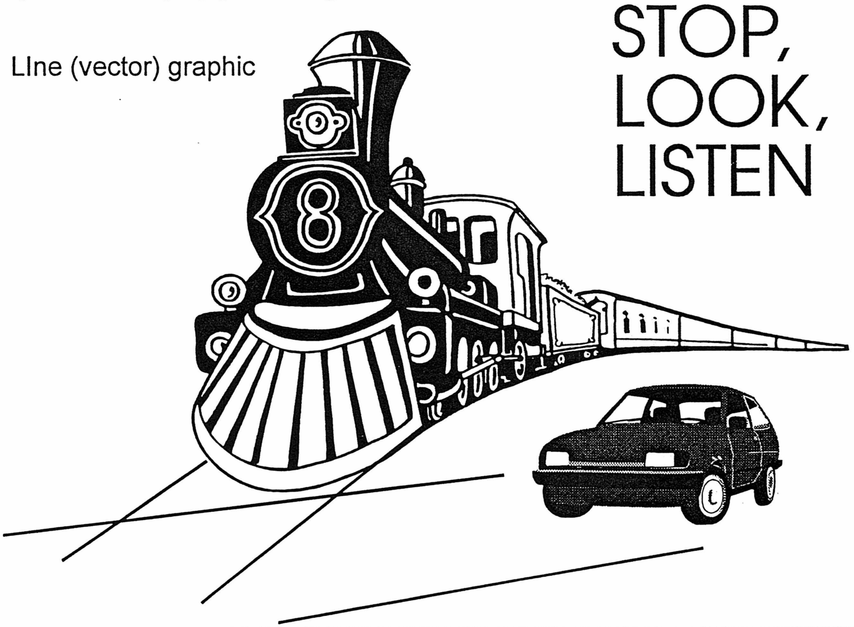
Video: High (378 x 240 x 16 colors)

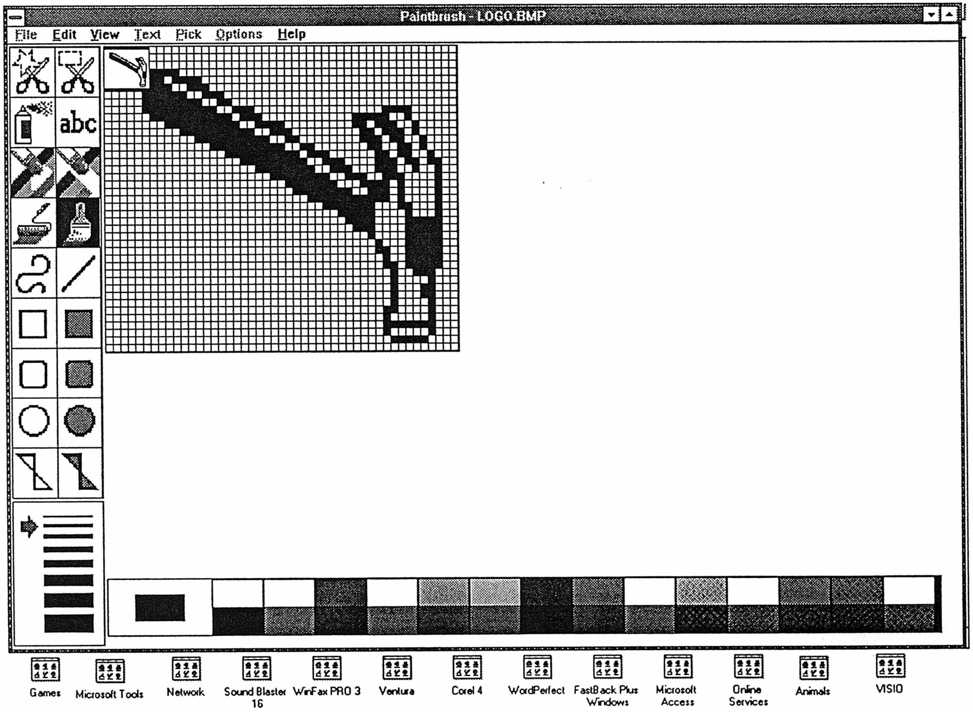
Graphics

The term **graphics** covers both **drawing** and **painting**. Engineers and designers use drawing programs which work with lines (called **vectors**) to produce high quality engineering drawings. Artists use painting programs which work with tiny dots called **pixels**.

You can add, delete, and change anything on your diagram, or move one, two, more or all elements of your diagram. And if you wanted to increase the thickness of all the lines, the computer can do this faster than you can blink. It can fill shapes, stretch them for perspective, mirror them, invert them, and duplicate them. In fact, what your graphics program can do is usually limited only by your imagination.

LIne (vector) graphic





Self Test

1. We use computers for the following functions (check all that apply):

☐ Drawing graphics
☐ Performing calculations
☐ Handling text
☐ Communicating with other computers
☐ Making decisions
☐ Organizing large amounts of information

2. Windows is (check all that apply):

☐ A graphical interface
☐ Consistent across programs
☐ An application program
☐ A multi-tasking environment

3. You would use a database to (check one):

☐ Spell check a letter
☐ Organize a mailing list

3. You would use a speadsheet to (check one):

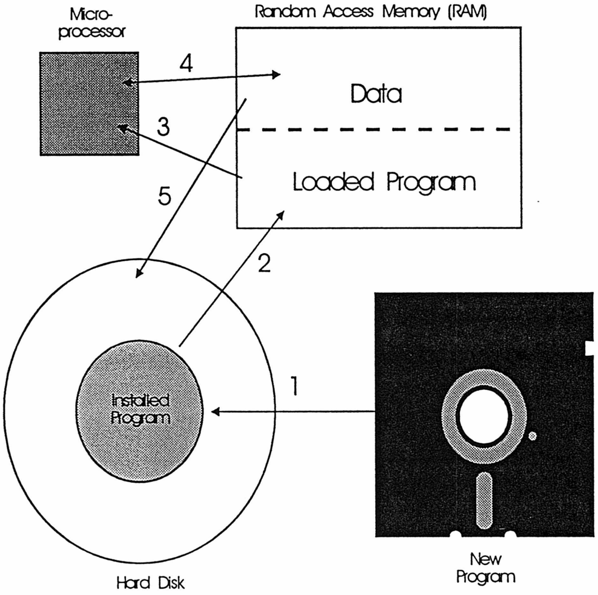
☐ Draw computer graphics
☐ Build rows and columns of numbers

Section 3:
More on Computer Hardware

As we've seen, the secret of the computer's flexibility is its **microprocessor** and **internal memory**. If the internal memory contains a word processing, spreadsheet, or data base program, then the computer is a word processing, spreadsheet, or data base machine until you load a different program into memory.

The microprocessor also stores your document, spreadsheet, data base or diagram in its internal memory, allowing you to can change it any way you wish. Of course, if the power goes off before you make a permanent copy, your work will be lost.

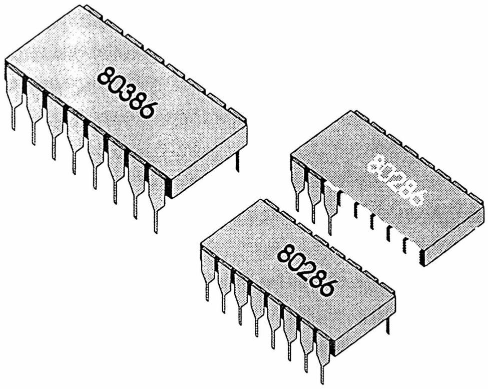
You can also copy previously saved work back into memory and continue working on it as often and as much as you like. In fact, this is the usual way of using computers.



Microprocessor

The heart of the computer is a tiny black chip called a **microprocessor** or **central processing unit** (CPU for short). This tiny electronic brain consists of millions of microscopic circuits that execute the program's instructions and perform all the functions we have talked about. Everything else in the computer exists to serve the microprocessor:

- The keyboard, mouse, and disk drives exist to feed data to it
- The monitor and printer exist to record what it's doing
- Internal memory exists to remember what's it's doing
- Programs exist to tell it what to do.



Types of microprocessor

They are grouped into families known by numbers:

- 1981—IBM enters the personal computer market with the IBM PC, based on a microchip made by Intel called the 8086 and 8088. IBM set the standard for internal design, so all machines based on this family of chips are called **IBM-compatible**.
- 1982/3—IBM soon followed with the PC/XT (for E**x**tended **T**echnology) also based on the Intel 8088 chip
- 1984—IBM launches the PC/AT (for **A**dvanced **T**echnology) using an 80286 chip.
- 1987—Intel announces the 80386 running at much faster speeds. Now Microsoft Windows finally has enough power to run (called 386 Enhanced Mode).
- 1990—Intel delivers the 80486 chip
- 1993—Intel announces the Pentium chip.

Each member of the 80x86 family is vastly more powerful and faster than its predecessors, but is able to run programs written for them. (The other major chip family is the Motorola 68000 series.)

Megahertz

The internal design of a chip determines the speed at which it works, that is, how many millions of instructions it can perform each second. In order to keep everything organized inside the microprocessor, it uses an internal clock. This clock produces electronic pulses called **clock cycles**. We measure the number of cycles in hertz (after Hertz, a pioneer of radio transmission). For example, the electrical supply works at 60 Hz. But because microchips work so quickly, we must measure in millions of cycles per second, so we call them **megahertz**, or **MHz** for short. The 486 chip works typically at **33 - 50 MHz,** but doubling the clock rate gives a speed of 66 MHz, and tripling will give us 99 MHz.

Turbo

Although chips like to work quickly, "warp speed" may not be suitable for all programs, especially game programs which interact with slow humans. So the computer manufacturer may offer two speeds, slow and **turbo**. Turbo mode is the chip's natural speed, but for compatibility with humans and slower programs, the chip is slowed down by slowing down its internal clock.

What *Really* Makes A Computer Go?

Operating Systems

We can't talk about **hardware** without talking about a special piece of software called the **Operating System**.

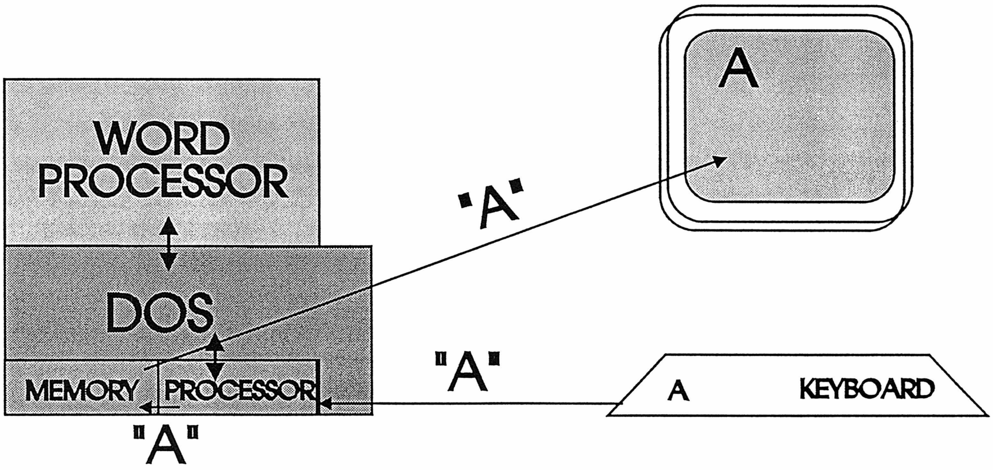
Data must be moved between the microprocessor and the outside world of memory, disks, keyboards, monitors, mice, and so on. When the processor needs data, such as a word processing document, it must execute this special program to get the file from a disk. Or when you have finished your document, the processor must execute the special program to send your document to the printer.

An **operating system** is very different from user programs like word processing, spreadsheet, and data base programs. The operating system is different because you must have one, regardless of how you use your computer.

DOS

The operating system that IBM-compatibles use is called **Disk Operating System** (DOS) because its real job is to manage data on disks, and move data between disks and internal memory. When IBM came out with the first PC, they asked Microsoft to develop this special software, and ever since then, most IBM-compatible computers use Microsoft's DOS or a variation.

DOS sits between **application programs** (like word processors) and the **hardware**, and it is the way that they use the hardware. When you type a letter on your keyboard, the word processing program asks DOS to get the microprocessor to display the letter "A" on the screen.



Internal Memory

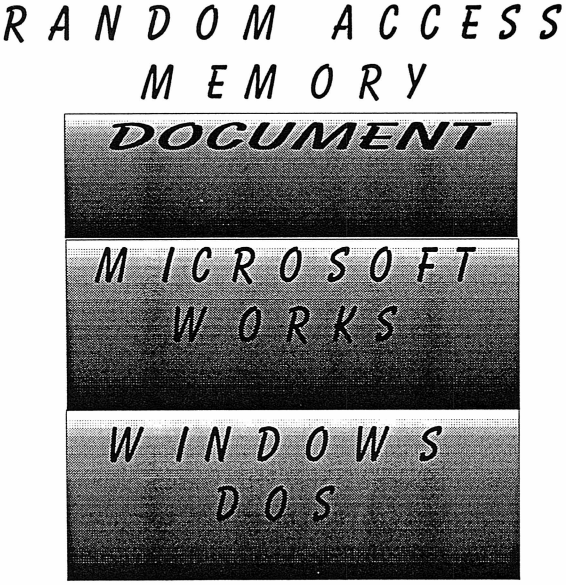
The computer's internal memory has two main functions:

1. The microprocessor works very quickly—faster than data can be read from or written to a disk. So, the processor needs somewhere to store its data while it's working.
2. We need somewhere to store the program we want the computer to perform.

So, the program and data you are working with at any time are both held in **internal memory**.

RAM

The microprocessor must be able to get to any piece of data or program in this memory very quickly, and in any order. That is, it must be **random access memory** (or RAM). Think of memory like an array of pigeon-holes that a mail sorter uses. The sorter looks at the address on a letter and puts the mail directly in the right pigeon-hole. That is the sorter's temporary "memory" for mail, just like it's the processor's temporary memory for data.



Save, Save, and Save

The emphasis here is on the word temporary. Programs and data on disk are as permanent as a movie on video tape or an album on an audio cassette. But internal memory, like a calculator, uses electricity to make it work. If you turn the power off, or if there's a power failure, everything in memory is erased! It's easy to reload the program once you switch the machine on again, but your data is lost for ever. If you've spent several hours composing a brilliant short story without saving it to a disk, you'll have to rewrite it from scratch. Saving a piece of work takes just a few seconds and can avoid much heartbreak. (See **Permanent Storage** below)

Bytes

The internal memory is made up of electronic storage "holes", with each hole able to hold one character, letter, or number. We call the holes **bytes** (no one seems to know why), and we measure the amount of RAM in thousands of bytes (**kilobytes**, or KB) or in millions of bytes (**megabytes**, or MB). A typical page of single-spaced text consists of about 3000 letters, so it would need about 3000 bytes of memory. And a 300 page novel would need almost a megabyte.

More Bytes

The size of memory limits the size of programs you can run, and the size of files you can work with. Until the late 80's, most machines had only 640 KB of RAM because that was all DOS could manage. This creates two problems:

- It limits the size of programs you can run, which means that they can't be very complicated.
- It limits the size of the data file you were working on, DOS has to swap data to and from disk, which also takes valuable time and slows the computer down.

Most computers today come with additional memory chip. This is usually **extended memory**. Until DOS 5.0 was released in 1991, you had to buy a special program to manage the additional memory. But DOS 5.0 and later versions come with a **memory manager**, and now up to 8 MB of RAM is common.

Bigger Is Better

Now that the 640 KB barrier has been smashed, we'll see many more programs that require much more memory as they get more and more ambitious and complex. Newer versions of graphics packages allow you to create more complex artwork, in thousands of different colors. But these can take up several megabytes of storage. If you want to use these programs to the fullest extent, you'll need to increase the RAM in your computer. But don't worry—each additional 1 MB of RAM costs only about $50. (In 1984, that same RAM cost about $1500.) Aim for at least 4 MB if you intend to use Windows especially for graphics or desktop publishing, and go for 8 MB if you can. (You can buy RAM in modules called SIMMs)

ROM

You'll hear the abbreviation **ROM**, for **Read Only Memory**. ROM contains the instructions needed to **boot** or start up the computer, and is prerecorded by the manufacturer. It cannot be overwritten and you do not have to worry about it or even know it's there.

Permanent Storage

While the computer is switched on, the microprocessor and RAM are the important parts of the computer, but we must have **permanent storage** for things we want to save when we turn the machine off, for data we want to move to another machine, and for a permenant record. The main form of permanent storage is the **magnetic disk**. We measure the capacity of disks in the same way as RAM—in **bytes**.

Just like audio or video tapes (but not like a CD), we can write over what's on a disk. If we don't want the data on a disk any more, we simply tell DOS to erase one or more files, or the entire disk, so that we can write new data on to it.

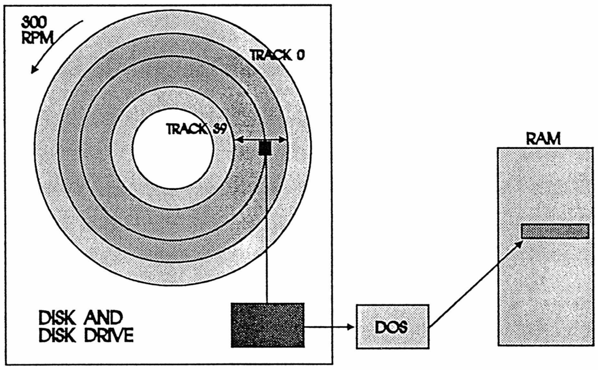
Types of Disk

We use two types of disk:

- Removable or **floppy disks** that we insert into a special read/write device (a bit like putting a cassette into a VCR)
- Fixed, or **hard disks** that stay inside the machine. These contain much more data than a floppy, and are much faster at writing and reading (recording and playback)

Floppy Disks

Floppy disks are flexible circles of the same material as audio and video tape (mylar coated with magnetic material). Data is stored in 40 to 80 concentric rings, called **tracks**. When a disk is put into a **drive**, a motor rotates it at about 300 rpm and a **read/write head** moves across the surface. DOS controls how data is read from the disk to memory, or written from memory to the disk. DOS is responsible for knowing where on the disk and where in memory to find and place data.



Formatting

When you take a new floppy disk out of the box, it is completely blank and unusable. We must use DOS to lay out the concentric tracks, and partition them into **sectors**. We call this process **formatting**, and until we do this, DOS cannot write to the disk. (Think of formatting as putting lines on a blank sheet of paper to help you write in straight lines.)

If you are sure that you no longer want the files on a disk, you can erase them one by one, or all at once. Another trick is to reformat the disk. This effectively wipes the disk clean, ready to be reused. (But be **very careful** not to reformat your hard disk by mistake. The DOS class goes into detail about formatting.)

Disk Density

As the technology for making **floppy disks** and disk drives improves, we can store more and more data on each track, and get more tracks on a disk. We used to be limited to 360 KB per disk, but now 1.2 MB and 1.44 MB (four times as much) are standard.

Disk Size

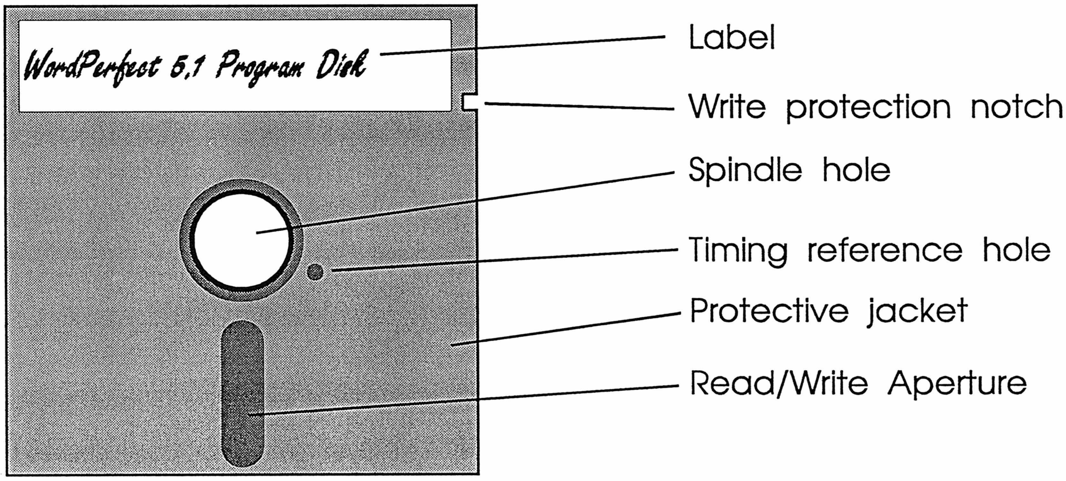
Some early floppy disks were 8 inches across, and then the industry standardized on 5¼ inches. Later, we developed a smaller disk—the 3½ inch disk which quickly caught on. Today, most software is offered on both sizes, so look on the box to make sure that the size of the disks inside matches your disk drive.

5¼" Disks

The most common form of this disk size used to be **double-sided, double density** (or DS/DD for short). Data is stored on both sides and the disk holds 360 KB. In 1984, IBM came out with the **high density** disk drive and disk (HD) that holds 1.2 MB. This has become the standard for 5¼" disks.

A high density (HD) drive can write to and read from a DD disk, but a DD drive cannot read a HD disk. Because the difference lies only in the way the tracks are arranged, you can put a DD disk in a HD drive and format it as a HD disk **BUT DO NOT!** The tracks on a HD disk are much closer together and require a much better magnetic coating than the lower density DD disks have. If you format a DD disk as a HD disk, it is almost certain that you will lose some or all the data within a few months.

Floppy disks are enclosed in a protective jacket with a central hole for the drive spindle, a small hole for timing purposes, and a larger aperture for the read/write head to move across the tracks. The disk is very vulnerable at this point, so be very careful not to touch the magnetic surface.



Write Protection

If you remove the plastic tags on audio and video cassettes, you can't record on them and overlay the previous recording. This valuable safeguard has been carried into the disk world. Disks have a notch on the right edge, and if this notch is open, you can change data and write over it with new data. But if you place a piece of tape over the notch, you **write-protect** it. If you try to write to the disk, DOS will tell you that you can't. Simply remove the tape and you can write to the disk again.

Using Floppies

Inserting the disk:

1. Push the disk into the drive label up, window first, until you feel resistance
2. Turn the knob or push the door shut.

Removing the disk:

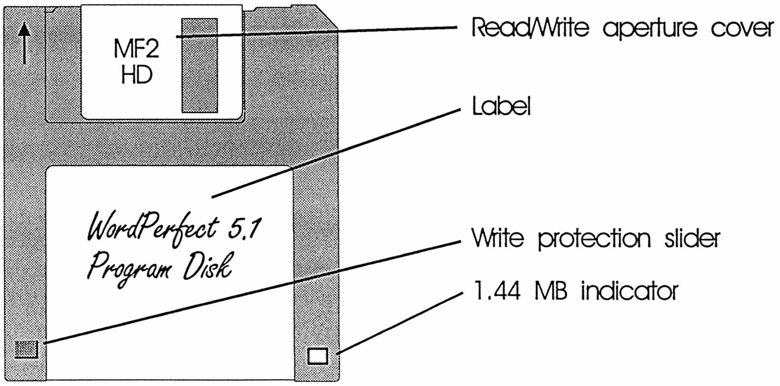
1. Wait until the light has gone out
2. Turn the knob or push the door in
3. Grasp the disk and withdraw

3½“ Disks

The principle of a rotating disk is still the same, but the 3½“ disk is a significant advance over the 5¼” because it's smaller, sturdier, and can be mailed more safely. But it's still not indestructible, so treat it with care.

The main differences are that:

- The read/write aperture is protected by a spring-loaded metal slide
- The write protect slot uses a plastic sliding square. If the hole is open, the disk is protected, and if the hole is closed, it's not protected. (This is analogous to the cassette where you can't record if the plastic tab is missing.)



3½“ disks and disk drives come in two capacities: 720 KB and 1.44 MB, but the industry has standardized on 1.44 MB.

Using Floppies

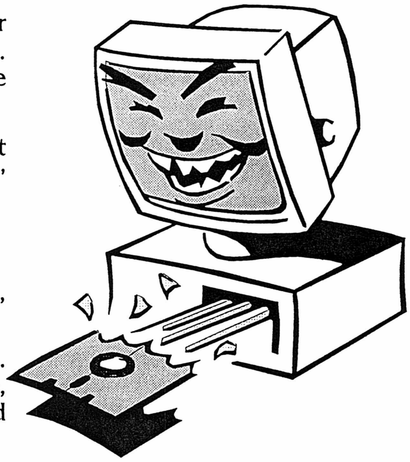
Inserting the disk:

1. Push the disk into the drive label up, window first until you feel resistance

Removing the disk:

1. Wait until the light has gone out
2. Push the knob to eject the disk

Disk Safety



1. Do not write on 5¼" disk jackets with a pencil or ball-point pen. This could score the disk inside. Instead, use a felt tip pen or prepare the label before sticking it on the disk jacket

2. Keep 5¼" disks in the paper envelope to keep dust out and fingers away from the disk itself. Keep 3½" disks in a plastic bag to keep dust out

3. Do not bend a 5¼" disk

4. Do not subject disks to extremes of temperature, high or low. Do not leave them in your car.

5. Do not expose disks to magnetic fields or magnets. Try to be aware of the magnets in your house or office, like loudspeakers, and the magnetic fields around appliances.

6. Be aware of the value of your data.

Write Protection

Write protect all important disks, like program disks you buy and disks containing valuable files. Write protection is valuable if you're copying a lot of files between disks and might get confused about source and target disks. You could inadvertently copy a new blank disk on to your full data disk and wipe everything out. So write protect your data disks before doing this or lending your disks to someone else. Not everyone is as careful as you.

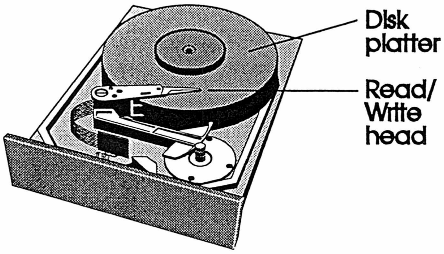
How Many Floppy Drives?

Of course, every machine must have at least one floppy drive, because that's how you load the programs you buy, back up your hard disk, and transfer data to another machine. Since no one buys a machine today without a hard disk, one floppy drive may be enough. Most vendors provide their software on both types of disk, but not all. If the software you'll use is available on 3½" disks, opt for that size, otherwise go for 5¼".

However, if you work with both the 5¼ and 3½ inch sizes, you'll need both types of drive in your machine. At about $50 each, the flexibility is worth it.

Hard Disks

Floppy disks are convenient ways of storing data outside the computer but they are slow and limited in capacity.



Hard disks work basically the same way, but they are:

- Non-removable
- Hermetically sealed
- Rotate much faster (3,600 rpm)
- Protected from vibration.

As a result, they can hold more data (350 - 500 MB is common), and read and write data much faster than floppy drives. The 1994 price for a 350 MB hard disk is about $350. That's about $1 per MB compared with about $50 per MB for a floppy drive and disks. And as with everything in the PC industry, capacities are going up and prices are coming down.

But...

With a hard disk, you can store thousands of files:

- Data you create
- Programs you buy
- Operating system and utilities.

But, it's very easy to lose a file in all that mess, just like you could lose a document you filed randomly in an entire room full of filing cabinets. No office manager would allow files to be dumped into the filing cabinets with no indexing or partitioning, and neither should we. We'll talk later about how DOS helps us to manage our disks and files.

CD/ROM

The hottest thing in mass storage today is the **Compact Disk/Read Only Memory (CD/ROM)**. Just like a music CD, the disk is recorded once and can be played back indefinitely without data damage or loss.

Compared to magnetic disks, the disk capacity is enormous, and you can easily change disks in a CD/ROM drive. CD/ROM is used for high-volume reference data like encyclopedias and clip art. CD/ROM needs a special drive, either internal to the system unit or external.

Monitors

Color or Mono

The first choice to make is: color or mono. Monochrome monitors provide higher resolution (or detail) for less dollars, and will probably cause less eye strain after several hours use. But many programs are written to take advantage of color monitors. For example, a word processor may use different colors for bold, italic, underlining, and so on.

The price of color, however, is lower resolution, but with improving quality and falling cost, most people opt for color. And, of course, any one who creates color output must use a color monitor.

Graphics Adapters

Monitors are driven by a special printed circuit card called an **adapter** which lives in one of the **expansion slots** inside the computer. This converts the data from the microprocessor and internal memory into data that drives the monitor itself. The card and monitor are usually a matched pair, and the computer dealer puts the two together.

Resolution

As adapter and monitor technology advances, **resolution** just keeps getting better. There are four industry standards of resolution:

- **Color Graphics Adapter** (CGA) offered 16 colors and medium quality graphics. Poor text quality caused a lot of headaches (literally).
- **Enhanced Graphics Adapter** (EGA) improved the quality of graphics and provided good text display which solved many of those headaches
- **Video Graphics Array** (VGA) scored vast improvements in graphics quality and was the industry standard in the late 80's
- **Super VGA** (SVGA) proved that things just keep getting better without getting more expensive.

Color vs. Quality

There's a trade-off between the number of colors and the resolution. We measure resolution in **pixels** (short for picture elements), and a VGA monitor typically displays either:

- Medium resolution = 640 pixels across and 350 pixels from top to bottom and 16 colors simultaneously, or
- High resolution = 640 pixels across and 480 pixels from top to bottom, but only 2 colors at the same time.

Working this out requires that you read the program and monitor manuals in some detail—not a pleasant thought—or get your dealer to match monitor and card.

What To Buy?

Based on the industry saying that something's out of date before you open the carton, go for the highest quality you can afford at the time. If you plan to spend several hours a day looking at the monitor, it must be the best possible. If you're using graphics, you need at least a VGA setup, preferably SVGA. Expect to pay about $500 for the monitor and $100 for the card, although you'll do better if you buy them as part of a package.

Keyboard

Additional Keys

The modern computer keyboard has a few surprises for the typist:

- The **ENTER** key tells the computer that your command is complete and ready to be processed. If the machine seems to have stopped, chances are it's waiting for you to hit the ENTER key. You must hit ENTER after all DOS commands.
  In a word processor, this key works like a NEW LINE key and creates a new line for the next paragraph.

- **Function keys** (the row of keys along the top labeled F1 - F12) are used by programs as short cuts to avoid typing full commands. For example, WordPerfect 5.1 uses F1 as the CANCEL key. Press F1 to undo whatever you just did. But WordPerfect for Windows uses F1 for the HELP key. Press F1 at any time and the HELP screen will appear. Each program uses the function keys in a different way.

- **Control (CTRL)** and **Alternate (ALT)** keys (either side of the space bar) modify the meaning of the other keys. For example, if you hold down the ALT key and press F1 in WordPerfect for Windows and you'll access the Thesaurus instead of Help. Or the Control key and F1 will bring up the Spell Checker.

- The **Escape** key (top left) may stop whatever is currently happening, but in other programs, for example, may jump you up to the next highest level in a set of menus.

- **Cursor control** keys (lower right) allow you to move the cursor anywhere on the screen. The cursor is the blinking line what marks the current position. In a word processor, this is where the next character you type will appear.

- The **Backspace** key is like the correcting feature on an electric typwriter, and will delete the character to the left of the cursor.(Hold this key down to erase more than one character.)

- The **Delete** key deletes the character at the cursor position.

- The **numeric keypad** has two uses. If the Num Lock light is on, the keypad produces the number on each key. This is often more convenient than using the numeric row on the main keyboard. If the Num Lock light is off, the keys will move the cursor instead.

- **Print Screen** tells DOS to print the current screen contents, but may not work with other programs. Holding the CTRL key down first will tell DOS to copy everything on the monitor to the printer, that is, to **echo** the monitor.

Choosing a keyboard

If you intend to use your keyboard a lot, it's essential that it "feels right." Try several boards out until you find one that offers the right resistance, and sounds right (most make an audible click which tells you that you've pressed hard enough). Literally let your fingers do the walking, and don't be pressured by the salesman. Choosing the board will make or break your productivity.

Printers

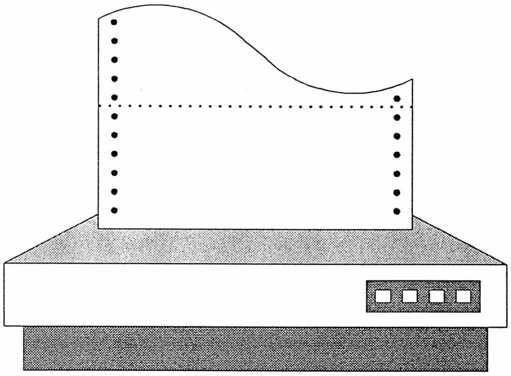
Printers produce the hard copy version of your work to file, mail, or duplicate, and are responsible for an avalanche of paper as we move into the so-called "paperless era."

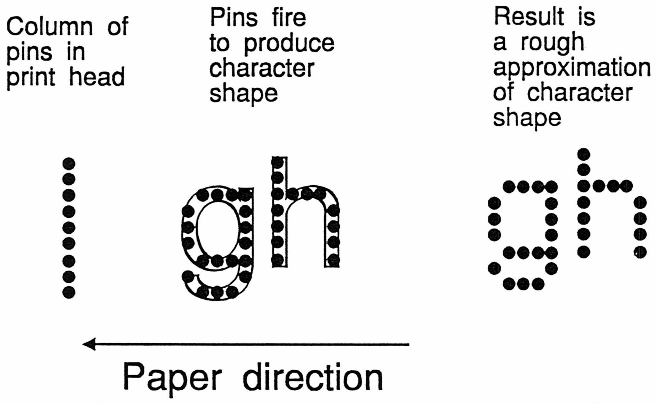
Because of their importance, the printer market is flooded with choices, and most are compatible with most computer systems (except for Apple/Macintosh whose printers are made specially for them).

Printer Types

Dot Matrix Printers

The **dot matrix** printer is reliable, cheap, and robust, and produces legible output, especially when on the **near letter quality (NLQ)** setting. Basic printers use a print head of 9 pins in a column behind an inked ribbon. The column of pins fire in particular sequences as the paper goes past the head to create the characters. (This explains the odd shape of the characters.) They produce NLQ by firing repeatedly, although this slows the print speed. More expensive printers have a 24-pin head and can produce better looking characters at a higher speed.




Column of pins in print head
Pins fire to produce character shape
Result is a rough approximation of character shape
Paper direction

Dot matrix printers typically print about 200 characters per second (CPS), but some zip along at close to 400 CPS. The actual speed you get will depend on what you're printing at the time. Most dot matrix printers use a head that sweeps across the paper and a tractor feed to move the paper through the printer. After removing the paper from the printer, you tear the perforated sprocket hole part off, leaving a relatively clean edge.

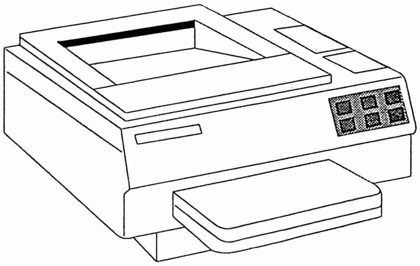
Ink Jet Printers

Instead of a matrix of movable pins, the **ink jet** printer fires tiny jets of ink through minute spray nozzles. Ink jet printers are very quiet, and they can print in color.

Daisy Wheel Printers

The characters sit the ends of spokes of a rotating wheel, and when the required character is at the right place, a hammer impacts the print head which then makes its mark through an inked ribbon. Because **daisy wheel** printers are using actual formed characters, they give letter quality. They are, however, slow and as noisy as fire crackers!

Laser Jet Printers



High quality, fast, silent, and affordable, **laser jet** printers have revolutionized personal computing almost as much as the computer itself. Under the control of output from the computer, a laser beam etches the required image on a drum which directs how the printer transfers powdered ink on to the paper. Because the laser can be controlled very precisely (300 dots per inch, or dpm), the printer can produce **near typeset quality** and incredible graphics.

Speeds are quoted in **pages per minute,** or ppm, and range from 4 up to 16 ppm, although a page of very complex graphics can take up to 15 minutes to print. Prices begin around $600 and go up to $15,000 and more for typeset quality. Most printers come with 512 Kb of internal memory. This is enough for simple text-based operations, but for graphics, or if you intend to use several different fonts, you will need another 2 Mb of memory, usually at an additional cost of $200 - $500 depending on the manufacturer.

Printer Drivers

When your word processor wants to print a character, the computer sends a series of pulses down the printer cable to represent the character. However, not all printers work the same, that is, they must be **driven** differently. Printers need a special piece of software in the computer that **translates** the generic character into the particular pulses that your printer needs. This special program is called a **printer driver**. Usually a family or group of printers from the same manufacturer use the same printer driver.

There are about 700 different printers on the market, and the software companies don't know what kind of printer you have. So they include printer drivers for all the common printers. When you install the software, the installation program asks you what type of printer you have, and it selects the correct driver.

If you later change your printer, remember to go through the installation process (usually abbreviated) again. You don't need to do this for programs written for Windows because when you installed Windows, it looked for your printer and self-installed the necessary drivers. All written-for-Windows programs then access your printer through Windows and do not need to know what type it is.

What To Buy?

Base price for a dot matrix printer can be less than $200. But if you can afford it, buy a laser jet printer . The cheapest laser jet (about $600) is about the same as a top-of-the-line daisy wheel, but is much more flexible. Of course, for near-typeset, camera-ready quality, there is no alternative to the laser jet.

Typical Price Sheet

Today, the prices are probably the best part of buying a computer. For less than $3000, we can buy machines providing power that was unheard of just a few years ago outside large, corporate computer centers. As a guide, the following shows the February 1994 price of a very powerful configuration based on the Dynova computer using the 486 chip:

486 33 MHz computer	$800
8 MB Memory	$400
101 Keyboard	$55
1.2 MB disk drive	$60
1.44 MB disk drive	$60
350 MB hard disk	$350
14" VGA monitor (1024x768)	$200
VGA card (with 512 KB memory)	$80
2400 baud internal modem	$75
Serial mouse	$70
Total	$2150

However, you it's much more economical to buy a prepackaged computer from a dealer. You could buy the same configuration for about $1750.

Self Test

1. Which of these statements is true? (check all that apply):

☐ RAM is the longterm repository for data

☐ RAM cannot be added to

☐ RAM contains data being worked on

☐ RAM gives fast access

☐ RAM holds the current program

2. Which of these statements is true? (check all that apply):

☐ A floppy disk must be formatted before use

☐ High density floppies can be formatted in a double density drive

☐ A computer must have at least one floppy disk drive

3.Which of these statements is true? (check all that apply):

☐ Hard disks rotate much faster than floppy disk drives

☐ Once data is on a hard disk, it's relatively safe

☐ Hard disks never fail, so our data is very safe

☐ Because hard disks hold so much data, we need to organize our data

Section 4: Introduction to DOS

What is DOS?

DOS stands for Disk Operating System, the standard operating system used by IBM-compatibles.

The operating system is probably the most important program running on a computer, because without it, the hardware is useless. It performs the basic tasks of handling the outside world of keyboards, monitors, disk drives, and printers, and the internal tasks of feeding data to the memory and microprocessor. DOS also manages data on disks, including the awesome task of tracking files and directories on hard disks.

Although DOS mainly used by the programs we run, we can get DOS to work for us by giving it commands directly.

Types of DOS Commands

We instruct DOS to perform operations by means of commands. The types of command include:

- Telling the computer what's going on in the outside world, e.g. date and time
- Copying, moving and deleting individual file
- Managing floppy and hard disks
- Organizing files on hard disks, e.g. directory-oriented commands

DOS Command Line

We tell DOS what to do by typing commands against the DOS prompt. The prompt usually looks like **C:\>**. The blinking **cursor** after the > tells us that the ball's in our court, and we begin typing the command at the cursor immediately after the > symbol.

A typical DOS session could look like:

```
C:\WINDOWS>copy vbrun100.dll c:\windows\temp
        1 file(s) copied

C:\WINDOWS>copy bootlog.txt lpt1
        1 file(s) copied

C:\WINDOWS>del c:\windows\temp\vbrun100.dll

C:\WINDOWS>doskey

C:\WINDOWS>
```

DOS commands consist of four segments:

1. The command itself, like COPY, FORMAT, ERASE
2. The source directory or filename
3. The destination or target directory or filename
4. Switches that modify how DOS executes our command

DOS Command	Source file	Destination	Switches
copy	**c:\myfile**	**a:\yourfile**	**/a**

With many commands, items 2, 3, and 4 are optional, but if they are included, they **must** be separated by a space:

Command	**Source**	**Destination**	**Switches**
`COPY`	`filename1`	`filename2`	`/a`

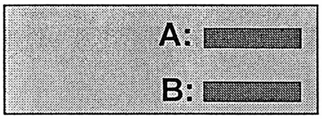
Note that each segment of the command is separated from the others by a **space**. Because we use spaces to separate command segments, **do not put spaces with a segment**.

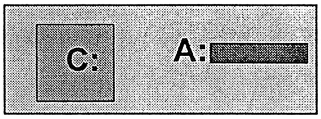
Finally, press the **ENTER** key after typing a command, otherwise DOS will wait for ever.

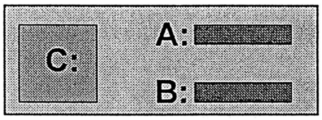
Drive Letters

We use a shortcut name for disks. files. Each drive is given a letter followed by a colon. The colon is a vital part of the drive identity, and DOS will not know that A means the A drive and C means the hard disk. **We must type A: or C:**

A: = first floppy disk
B: = second floppy disk
C: = first hard disk
D: = second hard disk or CD-ROM drive







We must always know which is the **active drive**, in other words, which disk the next command will affect— one of the floppy drives or the hard disk. Therefore DOS includes the current disk letter in the prompt:

```
C:\>_
```

To change the current drive, simply type in A: or B: against the prompt, and DOS will switch to A: or B: Do not include anything else (such as another DOS command or a filename) with the A: or B:

To switch back to C:, simply type C: at the prompt.

File-oriented Commands

File Names

Files must be named so that DOS can retrieve them later. DOS is quite picky about file names and we must follow the rules. File names have two parts:

- **Filename**, consisting of up to 8 characters.
- **Filename extension**, consisting of up 3 characters. This is optional, and is usually used to indicate the type of file, like .EXE which indicates that the file is a program file that can be executed.

If we use an extension, we must separate it from the filename by a period, like COMMAND.COM or SMITH.LTR, but if we do not use an extension, we leave the period out, as in SMITHLTR

File Types

A **file** is a **named collection of data or information**. Whenever we save data from memory to a disk, DOS creates a file and asks for a **file name** in order to add the file to its index of what's on the disk. There are many different types of file:

- **Text files** from word processors, like letters, reports, memos, and dissertations. These files consist of one large block of text. Word processors like WordPerfect, Word, and Multimate also allow us to build files consisting of lots of small name and address records for merging with standard letters and for printing name and address labels. Typical file extensions are .WP, .DOC, .TXT, .WRI, .SAM

- **Spreadsheet files** from spreadsheet applications like Lotus, Excel, and Quattro Pro. Typical extensions are .WK1, WKS, XLS.

- **Data base files** from applications like dBase and Paradox. Data base files consist of hundreds or thousands of individual records, each record holding specific information about one person, place, or thing. Typical extensions are .DBF, .WDB, MDB.

- **Graphics line art files** from graphics programs like CorelDraw and Adobe Illustrator. Graphics line art files consist of lines, circles, other shapes, and text that make up the image, plus all the data needed to display and print the image. Typical extensions are .WMF, .CDR, .GEM.

- **Graphics image files** from paint programs like PC Paint and PC Paintbrush. Graphics image files consist of thousands of black dots that make up the image, plus all the data needed to display and print the image. Typical extensions are .PCX, PIC, GIF

- **Application program files** for applications like WordPerfect, Ventura Publisher, and Lotus 1-2-3. These files contain the instructions for interpreting your input (via keyboard and mouse), displaying work-in-progress on the screen, doing all the necessary processing, and generating the required printed output. Typical extensions are .EXE, .COM, .PIF

- **System program files** for system programs like DOS and Windows. These files contain the detailed instructions invoked when you issue a command like FORMAT or COPY.

List Files [Dir]

The term **directory** means a group of files on a hard disk or a floppy disk. To get DOS to list all the files in the directory of the disk in the A: drive, for example, we type:

```
C:\>DIR A:\
```

and DOS will display a listing like:

```
Volume in drive A has no label
Directory of A:\
JANRPT      WP     9,451   02-10-91     1:45P
FEBRPT      WP    10,134   03-11-91    10:15a
MARRPT      WP     9,896   04-09-91     4:32p
SMITH       LTR    1,098   03-15-90     2:24p
SMITH       WKS    7,640   12-23-91     4:10p
SMITH       MEM    4,590   12-23-91     5:29p
JONES       DOC   12,398    7-16-90     8:13a
7 file(s) in 55,207 bytes
      1,158,925 bytes free
```

Each file entry in the listing consists of:

- Filename of up to 8 characters
- File extension of up to 3 characters [note the left alignment]
- File size in bytes
- Date and time created or last updated

To list the files in a hard disk directory such as WP51, we type:

```
C:\>DIR C:\WP51
```

Self Test

1. Which of these statements is true (check all that apply):

☐ DOS is essential for the PC to work

☐ DOS allows a computer to communicate with other computers over phone lines

☐ We must press the Enter key to tell the computer to execute a DOS command

☐ All DOS commands consist of four parts

☐ If a computer has only one floppy disk drive, the hard disk is called the B: drive

☐ To save our data, we must provide a filename

2. The DOS command to list all the files on a disk is (check one):

☐ LISTFILE

☐ DIR

☐ FILELIST

3. The filename extension .DOC means that the file is (check one):

☐ A speadsheet

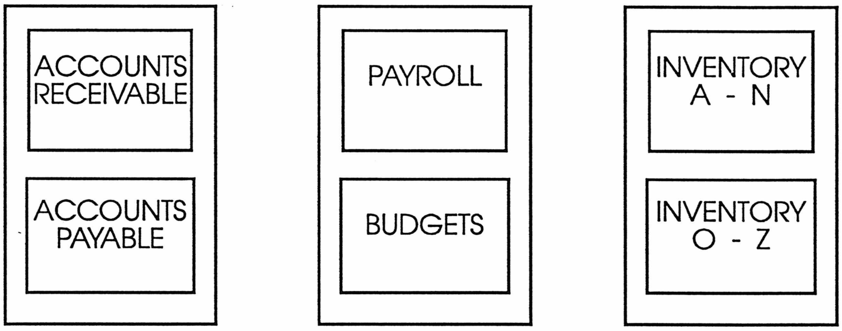
☐ A word processing document

☐ A database file

Section 5: Directories and DOS

If we had a manual filing system of thousands of folders covering many different aspects of our work, we would devise a way of organizing them, such as:

- Accounts Receivable
- Accounts Payable
- Payroll
- Budgets
- Inventory



In other words, we would partition our data for fast, easy retrieval in the future so that if we wanted the Smith's account data, we would not have to start at the first file and systematically work our way through.

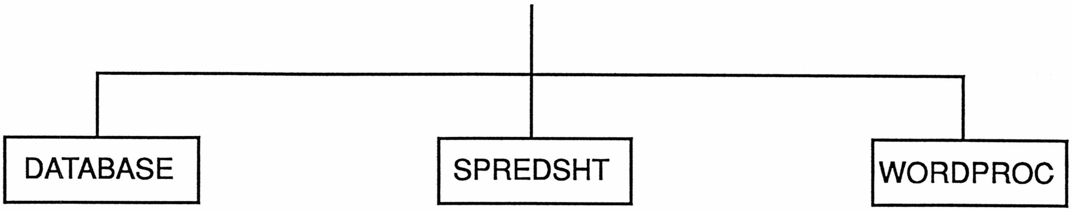
When we use a hard disk, we also use the idea of filing cabinets, except that it's inside the hard disk to partition our data. There are countless ways we can do this. But because we can perform many types of activity on a computer, one way is to partition our data by application, such as:

- Word processing (WordPerfect, Word, etc)
- Spreadsheets (Lotus, Excel, etc)
- Data base (dBase, Paradox, etc)

This means that we hold all the files associated with an application together, and can easily remember where we put them. Also, we can tell the application where to put data files once only, and let it remember for us.

Directories

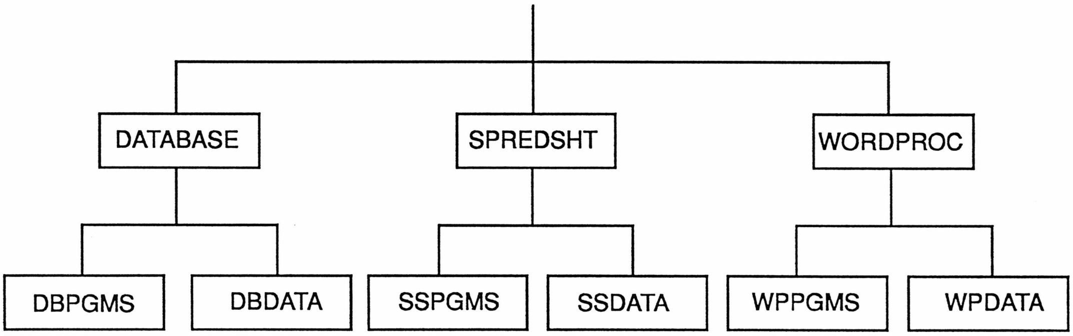
We call these partitions **DIRECTORIES** and so, we may have three directories: DATABASE, SPREDSHT, and WORDPROC:



Within each directory, we may have several types of information. For example, our word processing directory may hold:

- Letters
- Memos
- Reports
- Forecasts.

If we're smart, we'll also separate these within our word processing directory, because it will help us find a particular file later on. We can make **SUBDIRECTORIES** within each directory to keep the different kinds of work we do separate, like letters, memos, and reports. Or we might want to keep our data files separate from our program files:



The terms **directory** and **subdirectory** are interchangeable, because every directory is a subdirectory of another.

Directory-oriented Commands

Root directory

Directories keep track of files, but how do we keep track of the directories? Every disk has a top level, master directory that lists the first level of subdirectories on the disk. We call this top level the **root directory**.

The **root directory** can hold files too, but that's not its main purpose. It's really the top level directory, and it lists the first level of directories on the disk and contains the tables that tell DOS where everything is on the disk. Every disk **must** have a root directory, even floppy disks where it's called A:\ or B:\). Because DOS makes the root directory for us when we format a disk, we can delete every other directory on a disk **except** the root directory.

Backslash

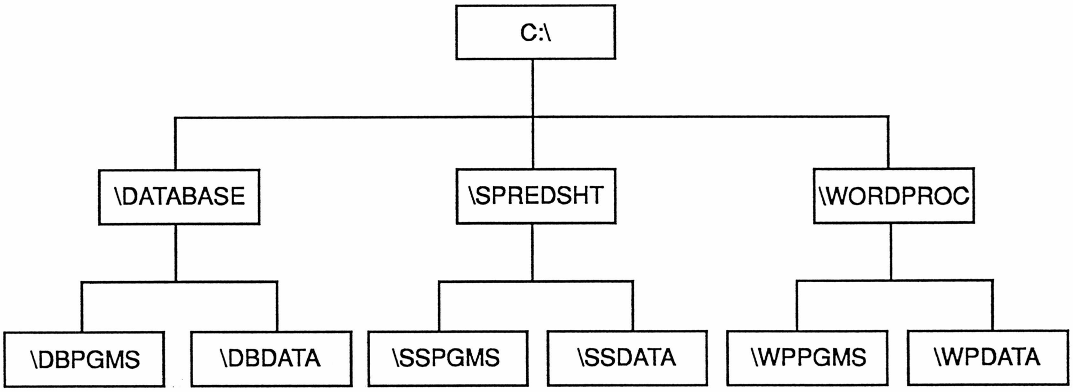
In DOS commands, we denote the root directory by a backslash but no name, i.e. \

We denote our floppy disk drives by A: and B:, and we denote the root directory of the floppy disk in A: by A:\, and of the floppy disk in B: by B:\

Similarly, we denote our hard disks by C:, D:, and so on, and we denote their root directories by C:\, D:\, and so on.

Tree structures

Imagine the directory structure like an upside down tree, with the root at the top and the branches going downward:



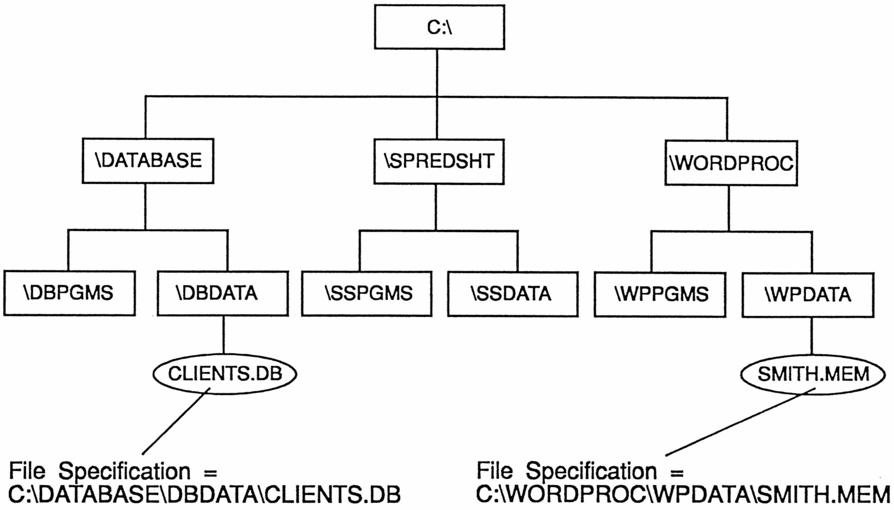
Directory naming

Except for the root directory, every directory must have a name, just like filing cabinets. The rules for naming directories are the same as for file naming. That is, directory names can be up to 8 characters long, with an optional extension, and must be unique. We must also avoid the same reserved characters as for file naming.

File Specifications

Once we partition files up into directories, it's no longer enough just to work with file names. We must also tell DOS where to find the file. Therefore, the full file specification consists of

Drive letter + directory + filename.ext as in **C:\DATABASE\DBDATA\CLIENTS.DB**



File Specification = C:\DATABASE\DBDATA\CLIENTS.DB

File Specification = C:\WORDPROC\WPDATA\SMITH.MEM

File names must be unique within a directory, but not within the entire disk. Thus, we could have a file called SMITH.MEM in other directories.

Summary of Directory-oriented Commands

Copy	`COPY X:\directoryA\filename1 Y:\directoryB\filename2`
Change	`CD \directory pathname`
Make	`MD \directory pathname`
Remove	`RD \directory pathname`
List files	`DIR \directory pathname`

Self Test

1. Which of these statements is true (check all that apply):

☐ Directories allow us to organize files on our hard disk

☐ DOS automatically creates directories for us

☐ It's a good idea to combine program files and data files in the same directory

☐ We can create several levels of sub-directories

☐ We separate subdirectory names with a slash mark, i.e. /

☐ Filenames must be unique within a hard disk

2. We denote the uppermost directory on a disk as (check one):

☐ TOPDIR

☐ \

☐ ROOTDIR

3. To specify a file in a directory, we must (check one):

☐ Point to it with a mouse

☐ Type its filename

☐ Give the drive letter, the directory path, and the filename

Glossary

This glossary defines terms you will commonly encounter in purchasing and using computers. For other terms that are application-specific, refer to the program documentation for their meaning. In the following definitions, terms in bold italics also appear in the glossary in their own right.

A

abort	Deliberate or unexpected termination of a program. You can instruct a program to suspend during a long operation like printing or data base searching, or a program may hang up due to bugs, incorrect input, hardware malfunction, or an unexpected condition. (Applications running under Windows 3.0, for example, may abort due to data and programs being overlaid in memory. You will get the message "Unrecoverable Application Error," and you must exit Windows and restart. (also known as a crash)
access time	The time a program or device takes to retrieve data and make it available to the microprocessor. Access times for memory (also called random access memory, or RAM) should match the processor's speed. Typical RAM access times are 15 to 50 nanoseconds (billionths), allowing about 20 million cycles per second. Because hard disks are mechanical devices, typical hard disk access times are 10 to 100 milliseconds (thousandths), allowing about 10 to 100 accesses per second. Even though disks are fast, notice the wide difference between RAM and disk access times. To speed up your work, when you buy a computer, go for as much RAM as you can afford.
adapter	A printed circuit expansion board that provides specialized processing and control on behalf of the microprocessor. It fits in a computer's expansion slot and supports a device like a monitor or a mouse, or connects a computer to a network.
alphanumeric	The set of letters (A - Z) and numeric characters (0 - 9). File names and field entries are often limited to these, plus the characters @, #, and $.
Alt key	Short for Alternate key. Like the Control (or Ctrl) key, holding down the Alt key modifies the function of other keys. Manuals usually express this as "Alt + key."
analog	Continuous rather than discrete, or digital. For example, clocks and watches can be analog (continuously sweeping hand) or digital (discrete read out that jumps from one minute or second to the next). Early monitors were analog, but EGA and VGA monitors accept digital signals from the computer and translate them into analog for display.
ANSI	Acronym for American National Standards Institute, which determines the standards for many technical areas, including computers. Greatest impact is in how computers represent the characters we work with. Windows applications use the ANSI character set, whereas DOS applications use another standard known as ASCII. For example, the letter "a" is represented by the numbers 97 in ASCII and 097 in ANSI. But the numbering diverges for non-standard characters, for example ANSI 0169 and ASCII 189 both mean ©. In order to insert these special characters, you must know which system your program uses. If you run Windows on a DOS machine, you will see a device driver file called ANSI.SYS in your CONFIG.SYS file tells DOS that this is an ANSI machine.
applications	Programs intended for users, like word processing, graphics, data base, and spreadsheet programs. Application programs sit on top of the other major type of programs, operating system programs, that interact directly with the hardware.

arrow keys	Cursor control keys that govern the movement of the screen cursor or pointer. Their operation may be different when used in combination with other keys, like Control, Alt, Shift, Home, End, Page Up, and Page Down.
ASCII	Acronym for American Standard Code for Information Interchange. Provides a standard representation for English characters using numbers from 0 to 127 that allows data to be exchanged between different types of computers. Extended ASCII uses the range 128 through 255 for additional non-English characters like “. When IBM adopted ASCII representation for the PC, the rest of the industry followed, so ASCII is now the de facto standard. Windows applications, however, use the ANSI standard. Text files stored using the ASCII format are called ASCII files, and all word processors support this format. If you have difficulty moving documents between incompatible word processors, use the ASCII format. However, this format does not support any formatting, like tabs, centering, and indentation.
asynchronous	A communications protocol in which either or both ends can transmit as they wish, as in a normal telephone conversation. In order for the receiver to know what's going on, the transmitter must include start and stop bits at the beginning and end of the message. (These increase the size of a transmitted byte to 10 bits rather than the 8 that are required for the computer's normal internal data representation.) The opposite of synchronous in which each end must wait for its designated time to transmit.
AT	Advanced Technology, or the computer that IBM introduced in 1984, based on the Intel 80286 microprocessor running at 8 MHz. Also the first machine to use the 1.2 MB, high density floppy disk drive. Used the Industry Standard Architecture (ISA) for internal data movement, and was the standard for 3 years until IBM brought out a new internal architecture called the Micro Channel Architecture, or MCA. In response, IBM's competitors developed the Extended Industry Standard Architecture, or EISA. EISA is not compatible with MCA, so expansion boards for one will not work with the other.
attribute	A quality or characteristic. In DOS, files have attributes like read only, hidden and visible, and last backup date. These can only be modified using the DOS ATTRIB command.
autoexec.bat	Automatic execute batch file. DOS automatically executes this file during the computer boot sequence. Use it to hold files that you want executed during booting, like the PROMPT and PATH commands. Also, if you normally use only one application program, you can go straight to the program from within the autoexec.bat file by including the sign-on command (e.g., “WP” for WordPerfect) within the batch file.
autosave	Feature of many application programs by which they save your data files at regular intervals, like 5 minutes. If you tend to forget to save your work regularly, this is an invaluable feature.

B

background	Multi-tasking computers can run more than program at one time. However, only one program can usually accept input from the keyboard. This is called the foreground process, as opposed to others, called the background processes. Print spoolers are commonly run in the background. These drive the printer from a disk file while you are doing other work in the foreground. The most common example of multi-tasking is Microsoft's Windows.
backslash	The character \. In DOS, \ represents the root directory and is also used to separate directory names in a pathname.
backspace	A key that moves the cursor one position back, deleting the character. Differs from the Delete key that deletes the character at the current cursor position.

backup	The act of copying files from one medium (usually a hard disk) to another (usually floppies or tape) for security. DOS provides primitive backup facilities, but powerful and sophisticated backup software is available (and recommended).
bad sector	A sector of a track on a disk that is unusable for some reason. This is inevitable during the manufacturing process, and when DOS (or similar) formats a hard disk, it locates bad sectors and marks them as unusable. If a hard disk sector goes bad after that, data may be lost and can be recovered only by special utility programs like Norton and PC Tools. (A disk utility is strongly recommended for anyone using a computer professionally because hard disk crashes are not uncommon, and a disk utility is the only way to recover your data.) Floppy disks should not go bad, but if they do, try to recover as much data as you can and discard the disk.
batch file	A file that contains a set of commands that you execute frequently. Batch file names have the extension .BAT and can be run by issuing a command containing the filename. For example, a simple DOS batch file called START.BAT could be invoked by entering START, and could contain: DATE TIME PROMPT [HELLO] This would prompt you for the date and time, and display the prompt HELLO. (The autoexec.bat file is the most obvious example of a batch file.)
baud rate	Used in communications to indicate transmission speed. A baud, named after the French engineer Baudot, is normally one bit per second. It takes 10 bits to represent a character, and modems typically run at 2400 bps, or 240 characters per second. (We rate modems in bps rather than baud because, due to clever electronics, we can get more than one bit in a baud.)
bios	Basic Input/Output System, encoded in a read only (ROM) chip. BIOS governs the internal operation of the machine and literally tells the machine how to be a computer, like how to write to a monitor and read from a disk drive. BIOS is put on a ROM chip to prevent alteration and corruption. All IBM-compatibles use basically the same BIOS, and DOS provides additional functions.
bit	A binary digit, taking the value 1 or 0. The computer represents a character using 8 bits.
boot	The process of starting up a computer, involving a self-checking diagnostic and progressively loading the operating system. Can be a cold boot (from a no-power state), or a warm boot (reload operating system without the preliminary system self-check).
Break key	Special keyboard key used to suspend certain functions. Used by only a few programs, notably communications.
browse	A mode used by word processing and data base programs in which you can view data quickly but not change it.
buffer	Temporary data storage, usually within RAM, to hold data before or after being processed by the microprocessor. During a work session, editing changes you make to a file are not written back to the disk each time, but held in a buffer and sent to disk when you save. This allows the changes to be recorded at the same speed as the processor works rather than wait for a time-consuming disk write. Another common use for buffering is in printing. Printers are extremely slow compared with the CPU, so the data to be printed is put in a buffer from which the printer driver can take it at the printer's speed. We call this print spooling. In DOS machines, buffers are 528 bytes. You can tell DOS how much RAM to set aside using the BUFFERS command in your CONFIG.SYS file. For example, the command "BUFFERS=30" will reserve 15 KB of RAM.

bug	An error or defect in software that causes it to malfunction. The term originated when an insect was "fried" across two terminals of one of the first computers.
bus	The internal "highway" connecting all the parts of the computer and supporting very high rates of data exchange. Buses can handle 16 or 32 bits simultaneously, hence the term 32-bit machine. (Note that the 80386 is a 32-bit chip but is often combined with a 16-bit bus, thus limiting the chip to 16 bits simultaneously.) There are three types of bus: • Industry Standard Architecture (ISA) used on the PC/XT (8-bit) and PC/AT (16-bit). Runs at 8 MHz clock speed. • Micro Channel Architecture (MCA). Requires Intel 80386 or 80486 processor and runs at 10 MHz. • Enhanced Industry Standard Architecture (EISA), a 32-bit, 8 MHz bus developed by IBM's competitors.
bus mouse	A mouse that connects directly to the bus using an expansion board as opposed to a serial mouse that requires a serial port.
button	In graphical user interfaces (GUI's), a box on the screen in which you can click to select an option or a command.
byte	A unit of storage for holding a single character. (A byte is made up of 8 bits (or binary digits) because it takes 8 binary digits to represent a character, and 10 bits for data communication.) Storage is measured in thousands of bytes (kilobytes, KB), millions (megabytes, MB), and billions (gigabytes, GB).

C

cache	An area of high-speed storage used to hold the data most recently accessed from a disk. If the data is needed again, the processor looks for it in the cache before going to the much slower disk. Caching can speed up data access by a factor of a thousand. Computers use two kinds of cache: • Disk caching. Involves holding the most recently accessed or written disk data in a special area of RAM. The processor looks there before making a ponderous disk access. • Memory caching. The 80486 microprocessor contains 8 KB of super fast memory for the current data, and looks there even before going to the slower RAM. Other machines use an area of special RAM that is faster than normal RAM.
calculator	A program that simulates a calculator on the screen. Using the numeric keypad, you enter numbers just like a physical, hand-held calculator, but with Windows, for example, you can transfer the result to the clipboard and use the data in another program.
calendar	A program that allows you to record appointments and other data within the computer. The program can enter standing engagements automatically, and remind you of their approach.
Caps Lock key	The key that, when pressed, switches the keyboard to uppercase until pressed a second time.
cartridge	Removable read only memory used, for example, to add fonts to a laser jet printer, or to contain the programs for computer games. The cartridge fits into a special slot in the device.
cascade	An arrangement of windows so that they overlap. (The alternative is a tiled arrangement.)
case	The feature that distinguishes uppercase from lowercase. Some programs are case sensitive, that is, a command will execute differently depending on the case. DOS is case insensitive.

CD-ROM	An optical disk, using the same technology as audio CDs, capable of holding over 500 MB per disk, equivalent to about 1000 floppy disks. Like audio CDs, they are recorded once by the vendor, but can be read an unlimited number of times. Used for reference data.
cell	In spreadsheets, the intersection of a row and a column, able to hold a numeric value, formula, or text. Cells are usually identified by the row/column coordinates, so the cell at the intersection of column B and row 4 is addressed as B4.
CGA	Color Graphics Adapter, the first color graphics monitor standard, developed by IBM in 1981. Very low resolution by today's standards (640 x 200 pixels).
CGM	Computer Graphics Metafile, the ANSI standard file layout for the exchange of vector graphics between graphics programs.
character	Any symbol requiring one byte of storage, but normally used for letters, numbers, and punctuation.
character-based	Programs that treat the monitor screen like a grid of small boxes to hold characters, typically 25 rows and 80 columns. (The alternative is graphics-based, that treats the screen as millions of tiny dots, called pixels.)
click	To depress a mouse button and immediately let go. Usually used to select the icon or option on which the pointer or cursor is currently resting. In many programs, double clicking chooses an icon and instructs the program to execute your choice. Differs from dragging (holding down the mouse button while moving the mouse) to move an item on the screen.
client/server	A network of computers in which one computer is dedicated to serving the others (its clients) by, for example, managing large data bases or the network's printers. Client machines are often less powerful than the server. (Differs from peer-to-peer networks in which each computer has similar responsibilities but can communicate with all the others.)
clip art	Preformed illustrations or graphic images that can be selected and inserted into documents by word processing and desktop publishing programs.
clipboard	A special buffer used by application programs to hold data temporarily during a cut and paste operation. For example, Ventura Publisher maintains three clipboards: frame, text, and graphics. Going further, the Windows graphical environment allows data to be moved between application programs running under Windows.
clock speed	The rate at which a microprocessor executes instructions. An internal clock synchronizes the various parts of the computer, and a simple multiplication may take about 20 clock cycles. But a 33 MHz processor makes 33 million cycles per second, so could perform about 15 million multiplications per second, if it could get the data fast enough. Some computers let you to slow the clock speed down (say from 33 to 12 MHz) to match speeds with slower add-on devices or human operators. In this case, the normal speed is called turbo speed.
clone	A computer or device that is internally the same as another and performs exactly like it. So, an IBM clone, for example, is built just like an IBM original. This differs from an IBM-compatible, which need not be internally identical but is able to run any program that the original can, and produce exactly the same results.
cold boot	Starting a computer up from a no-power state. Differs from a warm boot.
COM file	A DOS-based file of executable commands. Must have a .COM filename extension. Limited to in size to 64 KB, so large program files are usually made .EXE files.

command	A specific instruction to the computer, given by typing reserved key words (like FORMAT), using function keys, or selecting choices from a menu. The command consists of the function to be executed, and optionally parameters like file names or drive letters, as in: FORMAT A:.
command line	The line on the screen where you type the command, usually against a prompt, like C:\>
communications	The transmission of data between two computers, and includes the equipment and software needed to route, transmit, and verify data, such as modems. Software features include queuing and dialing, message editing, remote machine access, unattended response, transmission spooling and emulation (making a computer look like one of another type).
compatibility	The ability of hardware or software to work with other hardware or software, for example, most printers are compatible with most computers through a piece of software called a driver. Many programs will read data produced by other programs of the same type (like word processors) in order to be more attractive to users. (In cases of rampant incompatibility, a technique called emulation can be used, in which the hardware and/or software is deliberately fooled into thinking that a device is actually a type with which it can communicate.)
computer	A programmable machine which executes a predefined set of instructions, or program. In addition to the microprocessor, a computer consists of memory or RAM, mass storage such as a hard disk, input devices such as a keyboard and mouse, and output devices such as a monitor and printer.
CONFIG.SYS	A file that defines the computer to DOS that is read as part of the boot sequence. DOS executes any commands it finds, like "DEVICE =" commands which inform DOS of special features like memory management software or disk caching.
Control key	Used in conjunction with other keys, the Ctrl key modifies their operation.
controller	A device that relieves the microprocessor of some control responsibility, for example, the transfer of data to and from disks, keyboards, monitors, and printers. A new external disk, say, will also require a disk controller that is compatible with the computer's bus. (Also known as an adapter and an expansion board.)
copy	With DOS, the function of duplicating a file in the same or another directory. In application programs, the duplication of text within a document, a record within a file, or a graphics element (line, circle, etc.) within a graphic image.
copy protection	The technique of preventing the copying of a program. Popular at one time with vendors, copy protection is now uncommon because of technical difficulties and ease of circumvention.
cps	Characters per second. Used to measure of the speed of dot matrix printers.
CPU	Central Processing Unit, or microprocessor. Consists of an arithmetic unit, a control unit, and possibly high-speed RAM.
cursor	The indicator used on screen to indicate the position at which the next character entered will appear. Usually a blinking vertical or horizontal line.
cut	In applications, moving a block of text or a graphic element to a clipboard for later pasting.
cylinder	The vertical set of tracks on a hard disk.

D

data	Information (text, numbers, graphics, and so on) usually formatted for a specific application.
data base	A collection of data organized in ways that allow fast access. Data is structured by fields within records within files. For example, "SMITH" occupies the "last name" field within Smith's record, and his record sits with all other records of the same type in, say, the Customer file. We use a data base management system (DBMS) to organize the records, sort them, extract them, operate on all or just a few, and print them. DBMSs also support powerful query and retrieval languages. (dBase, by Ashton-Tate, is probably the most well-known DBMS.)
default	The value that a program or device uses automatically unless you provide a different value. For example, the manufacturer may set your modem to a default speed of 2400 bps, or you may set your default directory to C:\WORDPERF\WPDATA. This setting will be used until you change the default or override it in a specific command.
delete	Removal of: (1) a file from a disk, or (2) text, a record, or a graphical element from a file.
Delete key	The Del key removes the current character, field or graphical element. With a word processor, deletes the character at the cursor, which differs from the Backspace key which deletes the character to the left of the cursor.
density	The measure of how tightly packed information is on a disk. Floppy disk drives, for example, can be double density, or high density. Increased density requires better quality magnetic coating and better engineered components. It is unwise to use a disk at a density higher than its rating, so don't format a double density floppy as high density.
desktop publishing	An application that allows more sophisticated page formatting than a word processor, particularly in layout, type faces, margins and justification. DTP programs display the exact printed output on the screen, or WYSIWYG, for "what you see is what you get."
destination	The target file, directory, or device in DOS commands which move data from one file, directory, or device to another. (Opposite of source.)
device	A hardware component attached to a computer, such as disk drives, printers, and modems.
dialog box	An area of a screen that presents information and/or requests you to make a choice, usually by pointing and clicking with a mouse.
digital	Discrete rather than continuous, or analog. For example, clocks and watches can be analog (continuously sweeping hand) or digital (discrete read out that jumps from one time to the next). Early monitors were analog, but EGA and VGA monitors accept digital signals from the computer and translate them into analog for display. Computers handle digital data more easily than analog data, but because analog data is more suitable for humans, the computer must translate digital to analog for display, and back again for internal processing.
directory	A partition of data files on a magnetic disk into a hierarchical structure. Think of a directory as an inverted tree, with files at one level contained within the directory at the next level up. In order to access a file at any level, you must give DOS the names of all the directories directly above it, or the pathname. The topmost directory is called the root directory, and each directory below that is called a subdirectory (although often called just a directory).

disk	A round plate, made of magnetic material or optical material, on which data can be encoded. Data on a magnetic disk can be erased and recorded over, but data on an optical disk is usually recorded once only. Magnetic disks include: • Floppy disk, typically 5¼" and 3½", holding 1.2 MB and 1.44 MB respectively. Also includes the Bernoulli Box, holding disks of up to 20 - 40 MB. • Hard disk, storing from 10 MB to 5 GB. • Disk cartridge, typically with a 40 MB capacity. Uses an external drive into which the disk cartridge is placed like a floppy disk. Optical disks include: • CD/ROM. Written by the manufacturer, for read only (as with the music CD). • Write-once, read-many, or WORM. Blank disks on which you can write once only. • Erasable optical, or EO. All disks require a hardware disk drive with one or more read/write heads.
disk cache	A portion of RAM used to hold the most recently accessed disk data. When a program needs data from the hard disk, DOS first checks the cache in order to avoid the disk access, and when a program wishes to write data to disk, DOS temporarily stores it in the cache, writing it to the disk later for permanence. Caching significantly speeds processing.
disk drive	The device that rotates a disk and is equipped with heads to read and write data. Access times vary from about 500 ms for a floppy disk to 12 ms for a hard disk.
DOS	Disk Operating System, the standard operating system for IBM-compatibles. "DOS" can be prefixed by MS- (Microsoft's version) or PC- (IBM's version). There have been about ten versions over the last decade, most notably DOS version 3.3 in 1987 that first supported 1.44 MB floppy disks, multiple hard disk partitions, and improved backup. Version 5.0 in 1991 offered an improved shell and managed memory (RAM) above 640 KB.
dot matrix printer	A printer using a head made of an array of pins fired against an inked ribbon next to the paper. The pin array can contain from 9 to 24 pins, fired to approximate the shape of characters. Print speed varies from about 50 characters per second (cps) to over 500 cps.
dragging	Moving a mouse across a monitor screen while holding down a mouse button. This has the effect of selecting a block of text or group of symbols for further action, or moving the select text or symbols across the screen.
driver	A program that controls a device and acts as a translator between application programs and the device. For example, an application may issue a generic "print" command that the driver converts into specific instructions for the particular printer. As part of installing an application, you must tell the install program what type of printer, mouse, etc. you are using. The installation software will copy the appropriate driver from the installation software kit.

E

editor	A program that allows you to create and edit text files. Can be a primitive line editor (like EDLIN) or a screen editor like Window's Notebook. Screen editors differ from word processors by having only primitive formatting capabilities.
EDLIN	The DOS line editor which allows you create, edit, or delete one line of an ASCII text file at a time.
EGA	Enhanced Graphics Adapter, a monitor resolution standard supporting 64 color, 640 x 350 pixel resolution.

EISA	Extended Industry Standard Architecture, a 32-bit bus designed to compete with IBM's MCA, and based on the Intel 80386 and 80486 microprocessors.
electronic mail	An application that allows messages to be sent, stored, and received between the users of computers and terminals on a network. Usually supports party-to-party and broadcast messages. (Often called E-mail for short.)
emulation	The ability of a program or device to imitate another, thus allowing other devices or programs to work with it. Printers, for example, are often made to emulate Epson dot matrix or Hewlett-Packard laser jet printers because these have become the industry de facto standards.
End key	A keyboard key whose usage depends on the program running at the time. For example, may move the cursor to the end of the line, page, or file.
EO	Erasable Optical disk, on which users can write and over-write data. Able to store up to 1,000 MB on one 5¼" disk. Access time of 60 to 500 milliseconds is about that of a floppy disk.
Escape key (ESC)	Used to send an escape character to the computer to abort the current operation or move back up one level in a menu hierarchy.
executable file	A file of instructions written directly for the machine, and not readable by humans. For DOS systems, held as either a command (.COM) file, or an executable (.EXE) file.
expanded memory	DOS machines can handle up to 1 MB of memory (RAM). The lower 640 KB is known as conventional memory and the upper 384 KB as expanded memory. The latter is reserved for special purposes and is not available to hold data. Differs from extended memory which until 1990 could only be used by special programs like RAM disks. But Windows 3.0, introduced in 1990, contains an extended memory manager,. As a result, expanded memory is more restrictive than extended memory, and has became less popular.
expansion board	A printed circuit board that can be installed in an expansion slot in the computer to boost its memory or CPU power or to provide special facilities such as a video adapter.
expansion slot	A connection on the mother board to take a plug-in printed circuit expansion board such as a video adapter. Depending on the number of pins, the connector is called half-slot or full slot.
exporting	The output of data from one application so that it's formatted for immediate processing by another, for example, when a graphics program prepares clip art for pasting by a desktop publishing program. (The other side of the coin is importing.)
extended memory	Memory above the 1 MB of main memory supported by DOS. Available only with Intel 80286, 80386, and 80486 microprocessors. Expanded memory must be specially configured for use by DOS, but extended memory consists of raw memory chips and cannot be used by most programs without a special extended memory driver such as that provided by Windows. 80386 and 80486 can convert extended memory into expanded memory, however. For ease of installation, chips are supplied as a SIMM.
extension	Up to 3 characters that can be added after a filename to indicate the type of file. DOS recognizes .BAK, .BAT, .COM, .EXE, .LIB, .MAP, and .OBJ, and you should not use these for your files. You are free to choose other extensions that do not conflict with your applications. For example, Ventura Publisher reserves .CAP, CHP, .CIF, .VGR, .IDX, .PUB, and .STY for its own use. If you use an extension, separate it from the filename by a period.

external commands	DOS commands that do not reside in the COMMAND.COM file. The files containing instructions for executing these commands, such as FORMAT.EXE, must be made available to DOS. (COMMAND.COM commands are called internal commands.)
external modem	A modem not contained as an expansion board within the computer. They attach to the computer via a serial port. Advantages over internal modems are that status lights are visible and they can be moved between computers.

F

FAT	see File Allocation Table
field	The space allotted for an item of data, such as name field or address field. They can be restricted to letters and/or numbers, and stipulated to be mandatory, optional, or calculated. A collection of related fields is termed a record.
file	Any collection of related data, such as the instructions making up a program, a single span of text, a group of data base records, or an arrangement of graphical elements making up an image. Many programs store formatting and control information with the data.
file allocation table	The hidden file used by DOS to place and retrieve files on a disk. If a disk's table becomes corrupt, the disk is unusable and the data inaccessible. In this case, you must use a disk utility such as PC Tools or Norton Disk Doctor to rebuild the FAT.
filename	The name of a file. Must be unique within a directory but can be duplicated across directories. DOS imposes an 8 character limit on size and excludes some characters. Can be accompanied by an extension to indicate the file type.
floppy disk	A flexible magnetic-coated disk that can be inserted into a device that can write and read encoded information. The most common sizes are 5¼ inch, with a capacity of 1.2 MB, and 3½ inch, with a capacity of 1.44 MB, although some laptop computers use a 2 inch, 720 KB disk.
font	The combination of a typeface and size, for example, Times Roman 12 point, or Helvetica 72 point. Fonts are held in two ways: • Bit-mapped, in which every character in a font is held as an array of dots. To print the character, the array is sent to the printer, and because it has been predefined, it only need be retrieved from memory, which is faster than with scalable fonts. However, bit-mapped fonts take up more disk space (several megabytes), and are usually generated in 1 or 2 point increments. This is a problem when you resize a graphic because the text will change in jumps and not smoothly like the graphical elements. • Scalable, in which only a generic outline of the character is held in memory, regardless of size. The actual character to be displayed or printed is calculated at display or print time. The scaling operation takes processing time, but allows tiny increments of sizing (excellent for graphics). Also the outlines take up less disk space than bit-mapped because only one outline is stored for each character in the face.
foreground	Multi-tasking computers can run more than program at one time. However, only one can usually accept input from the keyboard at any one time. This is called the foreground process, as opposed to background processes like print spoolers that drive the printer from a disk file while you are doing other work in the foreground.

format	The process of preparing a disk to receive data that lays down the tracks that DOS will use. Hard disks require low-level formatting (done by the manufacturer) and high-level, or user formatting, often done by the dealer. When formatting a floppy disk, be very careful to include the drive letter in the command. If you just type FORMAT against the C:\ prompt, DOS will assume that you intend to reformat your hard disk, so make sure that you type FORMAT A: or FORMAT B:
formula	In a spreadsheet, an expression that defines how one cell relates to another. For example, the formula +A6*B3 in cell B4 means "multiply the contents of cell A6 by the contents of cell B3 and put the result in cell B4." If the values in cells A6 and B3 change, the application will recalculate the result.
fragmentation	When a file is written to a disk, DOS makes use of available space and may break the file up, placing it in several different parts of the disk, that is, DOS fragments the file. Under heavy usage, the files on a disk can become so fragmented that reading and writing are slowed down. For floppy disks, you can use the COPY or XCOPY command to copy files to another floppy. DOS reconstitutes the file during reading, and writes the file to a contiguous area on the target disk. This is not feasible on a full hard disk, however, so you should use a disk optimizer like those provided with PC Tools or Norton Utilities.
function keys	Special keys, labelled F1 through F10 or F12 that provide short cuts for telling an application what to do. Different applications use them differently, and often in combination with the Control and Alt keys.

G

GEM	A graphical user interface (GUI), developed by Digital Research Inc., that provides access to an application program's facilities through icons and menus to which you point with a mouse. Used for application programs like Ventura Publisher and GEMDRAW.
gigabyte	One billion bytes. (More precisely, when counting computer storage, a GB is 1024 MB or 1,073,741,824 bytes because, unlike engineers, we count bytes in multiples of 2)
graphical user interface (GUI)	A program that uses the monitor to provide access to an application program's facilities through icons and menus to which you point with a mouse. Notable examples include GEM and Windows. A GUI avoids the need for application builders to invent their own interface. The use of symbols for functions and commands frees the user from having to learn the command language. A GUI usually consists of: • Multiple windows for displaying files or running programs • Icons to represent programs, commands, files • A mouse-driven pointer for selecting icons, files, etc, • Menus for command selection
graphics	Computer facilities (printers, monitors, adapters) that work with pictures and images rather than text. Graphics applications include: • Paint programs, i.e., bit-mapped freehand drawing programs • Drawing and design programs working with vectors (lines and shapes that can be expressed mathematically such as Bezier curves). • Presentation graphics programs specializing in bar charts, pie charts, clipart and so on for presentations • Desktop publishing programs, involving page layout, graphics, and other design elements.

graphics file formats	There are several file formats for representing graphics images: • BMP: a bit-mapped format for Windows • CGM: Computer Graphics Metafile (in common use) • DXF: Data Exchange File, used by computer-aided design applications • EPS: Encapsulated Postscript, combining Postscript commands and TIFF format • GEM: A format used by the GEM GUI • HPGL: Hewlett-Packard Graphics Language. Widely used but not sophisticated) • PCX: Developed by ZSOFT for PC Paintbrush, now in common use by many other applications and optical scanners • PIC: Picture File created to represent Lotus 1-2-3 graphics and now supported by many other applications • TIFF: Tagged Image File Format, the industry standard for bit-mapped images • WMF: Windows Metafile Format, for exchanging files between Windows applications.
graphics-based	Programs that treat the screen as an array of millions of pixels. The alternative is character-based applications that treat the monitor screen like a grid of small boxes (typically 25 rows and 80 columns) to hold ASCII characters.

H

hard card	A hard disk and drive mounted on an expansion card and inserted in an expansion slot. They are faster than normal hard disks and are easy to install but they take up an expansion slot.
hard disk	A magnetic disk, installed within the computer, for storing data. Capacities vary from 10 MB to over 1,000 MB. Hard disks have extremely fast access, which can be further speeded by a disk cache that holds current data in RAM. Consists of a number of platters, coated on each side, each with a read/write head. Each disk is formatted into tracks, with the vertical set of tracks termed a cylinder. Three main protocols govern how data is moved between disk and memory: • ST-506: Early standard which supports MFM and RLL encoding • ESDI: Enhanced Small Device Interface, IBM's new standard for fast hard disks • IDE: Integrated Drive Interface, slower than ESDI but faster than ST-506
hardware	General term for physical devices
help	On-line documentation that comes with a program and is available to the user while using the program. Often context-dependent, that is, the explanation you get depends on the function you are performing at the time.
hidden file	In DOS, a file that users cannot access (prevents accidental corruption). Hidden files are not listed when you use the DIR command.
high density	Describes floppy disks and disk drives capable of holding or handling higher densities of data, such as 1.2 and 1.44 MB. (Compare with double density, of 360 and 720 KB.)
Home key	A cursor control key on keyboards, usually moving the cursor to the top left corner of the screen.
HP-compatible	Laser jet printers that emulate the Hewlett-Packard laser jet printer. Many other manufacturers made their printers look like the HP pioneer because HP's Printer Control Language (PCL) has become the de facto standard and all application programs include HP printers on their list of supported printers.

I

IBM PC	Strictly, the family of computers developed by IBM, but commonly used to refer to any IBM-compatible, or clone. Based on the Intel 8088, or 80x86 microprocessor. Are generally software-compatible, meaning that software written for one will run on any, within limits of speed and power. Uses two operating systems: DOS which runs on any PC, and OS/2 which runs only on Intel 80x86 models.
icon	A small picture or symbol used in GUIs to represent a file, program, or function. Clicking on the icon invokes the program or selects the file.
importing	The input of data prepared by another application so that it's formatted for immediate processing, for example, when a desktop application pulls in clip art for pasting that's been prepared by a graphics program. (The other side of the coin is exporting.)
industry standard architecture (ISA)	The bus architecture used in the IBM PC/XT and PC/AT computers.
ink-jet printer	A printer that works by spraying ink at the paper through small nozzles. Slow, but can produce very high quality, up to 300 dpi, and print in color.
insert mode	Text editors and word processors work in insert mode and typeover (overstrike) mode. In the former, characters you type are inserted at the cursor position, with the characters to the right moved to the right. In the latter, you overtype as the cursor moves to the right. Toggle between the modes using the Insert (Ins) key.
Insert key	Used by most text editors and word processors to toggle between insert and overstrike mode.
instruction	A rudimentary statement that tells the microprocessor what to do. Each DOS command, for example, breaks down into many primitive instructions.
integrated circuit	A small electronic device, made of silicon, housing thousands or millions of individual circuits. (also known as a chip.)
internal command	A DOS command whose instructions are contained within the COMMAND.COM file. Differs from an external command that needs an explicit file, like FORMAT.EXE.
internal modem	A modem that resides on an expansion board rather than as a separate unit outside the machine.

J

joystick	A pointing device that uses a vertical lever that can move in any direction. Unlike a mouse which must be moved to move the pointer, the joystick continues to direct the cursor as long as it's off the vertical position.

K

K	Short for kilo, or thousand. (In measuring computer storage, it means 1024 bytes since we count storage in multiples of 2.)

key	(1) A button on a keyboard, (2) In a word processor or data base program, a field used for record searching or sorting, like "Customer Name."
keyboard	Set of alphanumeric, punctuation, and special keys used to input commands and data to a computer. Most common are the AT Standard with 84 keys, and the AT Enhanced with 101 keys (also known as the 101 keyboard).

L

laptop	A small, portable computer, typically weighing 16 - 20 pounds. Operated by a rechargeable battery pack with about 4 hours duration.
laser jet printer	A printer that uses a laser beam to produce an image on a drum by altering the electrical charge. The drum then picks up toner (ink powder) and transfers it to paper using heat and pressure, printing an entire page at a time. Because it can replicate any shape, it can print graphics and an unlimited number of different text fonts. Fonts can be held in font cartridges or be downloaded from the computer as soft fonts. Laser printers are controlled by page description languages notably Hewlett-Packard's Printer Control Language (PCL), and Adobe's Postscript that can be used on IBM machines with special software.
letter quality	Print that has the same quality as typewritten characters. Laser jet, ink jet, and daisy-wheel printers can produce letter quality.
load	To copy a program from a disk to memory for execution by the CPU.
local area network (LAN)	A network of computers in close proximity, such as a floor of a building or one office. Each node computer has its own CPU and possibly hard disk. The network can be configured as client/server or peer-to-peer.
LPT	The name used by DOS to identify a printer, as in "LPT1 is the device connected to parallel port 1," and often used to refer to the parallel port. Some versions of DOS also use the abbreviation PRN for printer.

M

M	Mega, one million, as in megabyte (MB) or megahertz (MHz). (Actual value is 1,024,000)
MCA	Micro Channel Architecture. A bus developed by IBM for its PS/2 range and other high-end machines. It is a 32-bit, 20 MHz bus, and can support several CPUs. It is incompatible with IBM's earlier AT bus and old expansion cards will not work with MCA.
memory	A computer's internal storage for fast access to programs and data. Composed of RAM (or main memory), ROM, and other specialized types of chip which are used to speed processing. The memory available to the user is less than the total RAM because DOS itself requires a certain amount of memory. (You can tell how much memory is available by using the CHKDSK command.) The limit used to be 640 KB unless you used a special high-memory driver, but now DOS version 5.0 can handle up to 1 MB, and up to 8 MB is common under Windows.
memory resident	Programs that must not be swapped out to disk if there is insufficient memory to hold all programs needed at one time. In a memory crunch, DOS will swap all or a part of a non-resident program to disk until it's needed again.

menu-driven	Programs that display a list of commands, options, or file names from which you can choose using a mouse or keyboard cursor control keys. Differs from a command-driven program in which you must memorize the commands or options.
MHz	Megahertz, or million cycles per second. Used to measure the clock speed of a microprocessor.
micro channel architeture	see MCA
microprocessor	The silicon chip that contains the central processing unit, or CPU. Executes the low-level instructions that perform arithmetical and logic operations on data held in memory. Microprocessors form families of the same or similar type, such as the Intel 80x86 and Motorola 68000 families.
modem	Modulator/Demodulator, a hardware device that allows a computer to transmit digital signals over an analog telephone line by converting the computer's digital pulses into analog signals at the transmitting end. A second modem at the receiving end converts the analog signal back to digital for input to another computer.
monitor	The computer's display screen and associated graphics capabilities. Monitors can be monochrome or color, the latter able to show from 16 to over 1,000,000 colors. Screen size is typically 12 to 14 inches diagonally, although full-page monitors can be 16 inches in diagonal. The other major difference among monitors is resolution, that is, the density of picture elements or pixels. Resolution types are CGA, EGA, VGA, and Super VGA. Monitors must be matched to their adapter card. Depending on the signal it can handle from the computer, monitors can be digital or analog. Monochrome, CGA, and EGA modes use digital (or TTL) monitors, accepting digital signals from the computer, but VGA monitors are analog and use a digital/analog adapter.
motherboard	The main printed circuit board containing the microprocessor, memory, serial and parallel ports, and device controllers for keyboard, monitor, and disk drives. Because they are on the motherboard, these components do not use the bus . The board also contains expansion slots to accommodate expansion boards like the video adapter and internal modem.
mouse	A hand-held device whose movements across a flat surface govern the movement of a pointer on the monitor screen. A mouse is essential for menu-driven programs, graphical user interfaces, and desktop publishing and graphics applications. Mice can be mechanical which detect the movement of a small ball in contact with the flat surface, or optical, in which an inboard laser detects the movement across a light-reflecting grid on a special mouse pad. Mice connect to the computer in two ways: into a serial port or, more complicated, to the computer's bus via an expansion board.
multi-tasking	The ability to execute more than one program at a time. A CPU cannot actually execute more than one instruction at once, but by interleaving tasks at high speed, it looks as though it can.

N

near letter quality	A mode in which dot matrix printers produce characters that look almost as good as typewritten output. The cost of this quality is a low print speed, typically 30 cps.

network A group of two or more computers linked together for data sharing and/or resource sharing. The term includes:

- Local Area Network (LAN) in which the machines are physically close together
- Wide Area Network (WAN), which requires telephone lines
- Integrated Speech/Digital Network (ISDN) which uses special telephone lines that can handle speech and data simultaneously.

The other important aspects of networks are:

- Topology, that is, how the nodes are connected: star, ring or bus
- Protocol, or the rules by which the nodes communicate and share data, such as token ring in which the node with the electronic "token" has control
- Architecture, such as client/server or peer-to-peer.

Num Lock key The key that toggles the numeric keypad on a keyboard from numeric mode to cursor control mode. This feature is provided because some keyboards do not have special cursor control keys, so cursor control is provided by giving the keypad a dual function.

O

off-line A printer mode used for non-printing functions like paper advancement (form feed).

on-line A printer mode in which it will accept data from the computer for printing.

operating system The program that, in effect, makes a computer's hardware into useable equipment. It performs basic internal tasks like managing disks and the transfer of data between disks and memory, reading input from the keyboard, and sending data to the monitor and printer. The major operating systems are:

- CP/M, the first personal computer operating system for IBM-compatibles
- Microsoft's DOS, introduced in the early 80's which replaced CP/M
- IBM's OS/2 for its top-of-the-line machines. Contains more advanced features than DOS, like true multi-tasking.
- Xenix, a PC version of the powerful UNIX operating system used for workstations

optical disk A CD-like disk for storing large volumes of data, up to 1,000 MB. Can be:

- CD-ROM (compact disk/read only memory), pre-encoded by the manufacturer
- WORM (write once, read many). Can be written on once by the user
- EO (erasable optical), which can be written and overwritten just like floppy disks.

optical scanner A device that scans paper and digitizes the image to create a graphics file. It works by dividing the paper into a grid of cells or boxes, and detecting whether each cell is black or white, a shade of gray, or a color. It treats the scanned piece like an array of graphic elements and produces a bit-mapped file. The file can be handled in two ways: (1) You can include the image directly in a page layout, like a photograph, using a desktop publishing or graphics program. (2) You can use a graphics program to trace the bit-mapped image to produce a vector-based image that has a much "cleaner" appearance. Even if the original image is text, scanners cannot "read" the text for editing in a word processor. For this, you need an optical scanning program.

Features of scanners to know about when buying one include:

- Resolution, a measure of the number of cells in the scanning grid, typically 75 to 300 dpi
- Flatbed, which looks like a small photocopier, or handheld in which you move the scanner's reading head across the paper
- Size. Flatbeds can be half page or full page
- Gray scaling, in which the scanner recognizes up to 256 shades of gray rather than just black or white
- Color. Expensive and produce very large files.

OS/2	The IBM operating system developed for its more powerful machines. It has both a command line like DOS, and a graphical user interface like Windows.
overstrike mode	To type over an existing character at the current cursor position. (Differs from insert mode in which characters are moved to the right to make room for new characters.)

P

paint program	A graphics program that allows you to create bit-mapped images. In these, the image is built by dividing the screen into an array of pixels which can be filled black or color, or left empty. They contain a number of tools that simulate the effect of a brush, roller, spray can, eraser, and so on. (Differs from a vector-based program which uses mathematical expressions to create images from lines, curves, and circles.)
parallel port	An interface that supports sending several data bits in parallel, for connecting external devices, notably printers, to the computer. Uses a 25-pin connector, and is also known as a DB-25. The printer end of a cable uses a plug made of flat, gold-plated connectors, known as a Centronix interface.
parent directory	The directory above the current directory. All directories have a parent except the root directory. From the current directory, the parent is indicated by two periods, as ".."
partition	An area of memory or a disk, divided off for management purposes. A large hard disk, for example, may be partitioned into two or more areas, given unique drive letters. For example, you can partition a 120 MB disk into four, each partition of 30 MB and known to DOS as C:, D:, E:, and F:, say. DOS treats these like separate physical disks.
paste	To copy text or graphical element from a clipboard into a document or graphic. The pasted data must first have been cut or copied on to the clipboard.
path	(1) In DOS, the statement included in the autoexec.bat file that tells DOS where to look for executable files if it can't find the file in the current directory (2) The directory structure that must be navigated to move from the root directory to the target file. (also known as pathname.)
Pause key	A key used to temporarily halt the scrolling display of data when there is more data than will fit on one screen.
PCL	Printer Control Language, the page description language developed by Hewlett-Packard to drive their laser jet printers. (The other major language is Adobe's Postscript.)
PCX	The graphics file format, developed by ZSOFT (makers of PC Paint), and used by most optical scanners and FAX machines.
peer-to-peer	A network architecture in which nodes can share data with each other and have equal responsibilities. Differs from client/server in which a more powerful machine serves (i.e. makes its resources available to) client machines. Peer-to-peer networks are simpler but can't share heavy work loads between them.
PIC	The graphics file format developed by Lotus to represent graphics built using Lotus 1-2-3.

pixel	Picture Element, the single point in a screen array used to represent a graphic image. In monochrome images, a pixel can be on (black dot) or off (blank), and in color images, a pixel is represented by three dots (red, green and blue) each of which can be on or off. Pixels are close together and the eye fills in the gaps to make solid images. The higher the resolution of the screen, the more solid looking the image. EGA monitors typically use an array of 640 x 200 pixels (or 128,000 pixels), and SVGA monitors use an 1024 x 768 pixel array (or 786,432 pixels).
plotter	An output device widely used by designers and engineers that draws lines by means of moving pens. Differs from a printer that can only approximate lines by printing small, straight characters.
Postscript	Adobe's page description language for controlling laser jet printers. It is object-oriented, meaning that it treats text as graphical objects that can be scaled in minute increments. This allows Postscript to take advantage of high-resolution monitors and printers, which the bit-mapped approach cannot.
ppm	Pages per minute, the measure of a laser jet printer's speed.
printed circuit	A board on which chips and other devices are mounted and connected together by lines of solder laid down in a special "printing" process.
printer	A device that prints text and images on paper. Types of printer include: • Dot matrix, which uses an array of pins to form characters, striking through inked ribbon • Daisy-wheel, in which character shapes are arranged at the end of spokes around a hub. The wheel rotates and when the required character is at a hammer, the hammer strikes to create an impression through an inked ribbon. Limited to text. • Ink-jet, which sprays ink through fine nozzles at the paper to form characters and images. • Laser jet, in which a laser beam "writes" on a sensitive drum which attracts ink powder. The powder is then deposited on the paper. The factors to consider in selecting a printer are: • Quality. Laser jet and ink jet deliver near typeset quality, and daisy wheels produce typewriter quality • Speed. Among impact printers, the daisy wheel is slow (30 cpm) and dot matrix is fast (up to 500 cpm). Laser jets can produce up to 20 ppm. • Graphics capability. Daisy wheels can print only text, but the others can produce graphics of varying quality • Fonts. Daisy wheels can print only whatever font wheel is installed; dot matrix drivers can produce a limited set of fonts; laser jets and ink jets can print an unlimited variety of fonts (typefaces and sizes). • Noise. Impact printers (dot matrix and daisy-wheel) are noisy.
Print Screen key (Prt Scrn)	The key that causes DOS to copy the current screen contents to the printer. Application programs may or may not support this key.
program	An organized set of instructions that, when executed, makes the computer respond and behave in a certain way. For example, if you move a mouse in a diagonal line and click at both ends, a graphics program may draw a line between the two points, but a word processor may select a block of text. It is the set of instructions making up the program that determines how the computer will react.
prompt	In DOS, the symbol > that tells you that DOS is waiting for input. You can customize the prompt to include the date, time, or name of the current directory, as in: C:\WP51\REPORTS>

Q

QWERTY	The name affectionately given to keyboards with the standard English layout because of the sequence of characters on the top row. Purposely designed in the 19th century to slow typists down, it is now a major impediment to fast typing. The fingers move 16 times further than on a Dvorak keyboard, but due to inertia, the latter has not caught on.

R

RAM	Random Access Memory, the computer's internal, temporary memory that allows fast, random access to data in any location. Data to be processed by the microprocessor must be brought from an external medium like a disk before being worked on.
RAM disk	An area of RAM designated to hold data normally read from or written to a disk. Provides very fast access to data, but changes are temporary until saved permanently to a real disk. DOS supports a RAM disk by means of the VDISK (Virtual Disk) command.
record	In a data base application, a group of related fields, each of which contains an item of information. For example, we might hold ten pieces of information about clients, and the ten fields pertaining to one client would form a record, with one of the fields, such as last name, serving as a key field.
resolution	The degree of clarity of an image, particularly as it is displayed on (1) a monitor and (2) printed out. For printers, resolution is expressed in dots per inch (dpi), and a 300 dpi laser jet printer can squeeze 90,000 dots into a square inch. With monitors, we call the dots pixels, and a 640 x 480 pixel screen has 640 pixels on 480 lines, or about 2,000 per square inch.
Return key	(1) Marked Return or Enter, this key causes an application to go the beginning of the next line, as at the end of a paragraph. This is called a hard return, as opposed to a soft return which a word processor inserts as it wraps to the next line. (2) In DOS and other command-driven programs, it tells the program to execute the command that has been entered on the command line.
reverse video	A display technique that reverses the display mode, like black on white rather than white on black. Used primarily to highlight the current option in a menu-driven application.
ROM	Read Only Memory, the computer memory that has been prerecorded, usually with basic operating system instructions to be executed during a boot. Unlike RAM, it retains its contents even when the power is turned off.
root directory	The topmost directory in a file hierarchy. It is created by DOS when it formats a disk, and serves as a "master index" to lower level subdirectories, although it can hold files itself. It is expressed by the backslash character, as in C:\.

S

save	To copy data from memory to a permanent medium such as a disk. Any changes made to data are held in memory and are vulnerable to power loss until saved. Many programs have a built-in autosave feature in which you specify the interval in minutes before the next autosave. Otherwise, you must remember to save your work.

scroll bar	A vertical or horizontal bar at the side of a window to indicate the area of the entire display that is currently shown on the screen. The displayed area is usually white on gray. By pointing the mouse cursor at a point in the gray area, the program will jump to that part of the display. Alternately, you can click in the white area and drag it to the area you want. For less gross movements, you can click on the up or down arrow at the top or bottom, or at either side of the bar.
sector	A subdivision of a track on a disk. DOS typically creates 10 sectors per track. We call a sector that is unusable (because of irregularities in the magnetic coating) a bad sector.
server	A computer in a network that performs specialized functions for the others, termed clients. The server typically maintains large files and data bases, performs printing and network management, and is responsible for communications outside the network.
shell	The outer layer of a program, usually in the form of a graphical user interface, which is more user-friendly than the blunt command line. The shell uses menus or icons to present the options that the program provides. This avoids the need for a user to memorize the commands and options.
SIMM	Single In-line Memory Module, a printed circuit board holding memory chips. SIMMs are easier to install than individual memory chips.
software	Computer instructions that are executed by the microprocessor, or more generally, anything that is not hardware or data.
source	In a DOS command that involves moving data from one location to another, the original location from which data is to be moved. The target location is termed the destination.
spreadsheet	An array of cells containing data, arranged in rows and columns, where some of the cells' values are the result of a calculation performed on other cells. If the value in one of these cells changes, the result also changes. Using a spreadsheet application, you first define the nature of the spreadsheet (field sizes, type of contents, etc), and then enter either data or a formula to the cells. You can then print the spreadsheet, convert it to graphics like pie charts, or export it to a word processing or desktop publishing application.
subdirectory	Any directory underneath any other. Every directory except the root directory is a subdirectory. The terms subdirectory and directory are used interchangeably.
SVGA	Super VGA, a graphics standard that provides better resolution than VGA. Can be 800 x 600 or 1024 x 768 pixels.
swapping	The technique by which a program or file that is too large to fit in memory is brought into memory as needed. When another part is needed, some other part is swapped out to disk.
synchronous	A mode of communication that is regulated by clock pulse, as with the computer's internal transfers. Differs from asynchronous, the normal mode for data transmission between two computers over telephone lines.

T

Tab key	(1) The key that moves the cursor to the next tab stop in a word processor. (2) Used by some applications to step from one field to another in a group of items.

tape	A magnetically coated strip of plastic on which data can be recorded, as in audio tape. Access is slow and sequential, making tape an excellent medium for backing up disks and for long term storage. Tape cartridges can hold over 1 GB and are relatively cheap.
terminal	A device consisting of a keyboard and monitor for access to a computer. The term usually refers to a device with no intelligence, but some terminals can have a CPU and memory.
text	Data in the form of letters, numbers, and punctuation, organized into words, sentences, and paragraphs, to be formatted into lines and pages. Does not include data in tables or as part of a graphic image.
text mode	see character mode
TIFF	Tagged Image File Format, a very common format for bit-mapped graphics files.
tiling	An arrangement of windows in a graphical user interface (GUI) in which all windows are visible, unlike the cascade arrangement in which they overlay each other.
track	A circle on a magnetic disk along which data is written. Floppy disks typically have 40 or 80 tracks, and hard disks can have several hundred tracks. New disks are unformatted and must go through a formatting process to lay out the tracks. Until then, they are unusable.
TSR	Terminate and Stay Resident programs that are loaded during a boot and remain in memory while other programs are executing. TSRs include calculators, calendars, and notepads. They are usually invoked by hitting a hot key, a special key sequence like Ctrl + Escape.
typeface	The design of a set of characters, like Times Roman or Helvetica. The combination of typeface and type size is called a font.

U

UNIX	A powerful but unfriendly operating system developed by Bell Labs for workstations used for computer-aided design. With the increasing power of personal computers, a PC version called Xenix has been developed, but it is incompatible with DOS.

V

vector graphics	The term for graphics programs and images that use geometrical formuli to create images rather than an arrangement of dots, as in bit-mapping.
VGA	Video Graphics Adapter, a high-resolution color graphics standard using 720 x 480 pixels, or 320 x 200 pixels, able to display 262,144 colors. It is incompatible with lower resolution video adapters because VGA uses analog signals rather than digital.
video adapter	An expansion board that enables a computer to interface to a monitor. Adapters work either in text mode or graphics mode.
virus	A small program passed from one computer to another on disks or through a network that interferes with the normal operation of the computer. Viruses typically replicate and consume all available memory, bringing the machine to a halt, or worse, corrupting or deleting files on the hard disk. If you exchange data with other users, an anti-virus program is a wise investment.

volume label	The name of a disk volume allowing easier disk management.

W

warm boot	Resetting a computer that it already turned on. Used following a system crash which leaves memory in disarray. It clears memory but does not go through the initial diagnostic self-check. (Differs from a cold boot, in which the machine is brought up from no-power.
wild card	The symbols ? and * used in filenames to stand for any other character. ? refers to one character in its position only, whereas * stands for any number of characters. For example, the command COPY MYFILE?.WP would copy files with names like MYFILE0.WP through MYFILE9.WP, and MYFILEA.WP through MYFILEZ.WP. The asterisk is more powerful, and MY*.WP would involve all .WP files with MY as the first 2 characters.
Windows	The operating environment developed by Microsoft for providing a consistent environment for application developers. Windows provides a graphical user interface, but is much more. It contains a memory manager, clipboard, and other internal software that enhances the way DOS operates.
.WK1	The current extension for Lotus data files (early versions used a .WKS extension). Many applications can import .WK1 files directly.
WMF	Windows Metafile Format, a graphics file format used by applications running under Windows.
word processing	Text-based applications used to create and edit documents. Include powerful tools to format text, move blocks of text within a document, copy, cut and paste text, search for strings of text and replace with other strings, and print. Many word processors also include features like mail merge, font selection, check spelling, number pages, document linkage, and definition of macros (predefined sequences of frequently used commands. The more advanced word processors like WordPerfect for Windows and Word for Windows include features found in desktop publishers, like graphics capability, table of contents and index generators, and WYSIWYG display.
WORM	Write Once, Read Many, an optical disk technology that supports user writing once. Optical disks work by burning the surface with a laser to record, and reading by detecting the light reflected by a second laser. A worm disk can hold up to 1 GB.
write protect	The technique of marking a disk so that the drive's write mechanism is disabled, much like taking the plastic tabs off an audio cassette. 5¼ inch disks are protected by placing tape over the notch on the side. 3½ inch disks are protected by sliding a plastic tab so that a hole is open.
WYSIWYG	Short for "what you see is what you get," or the ability of a monitor to exactly replicate the final printed output.It involves generating fonts for the screen as well as for the printer and clear representation of graphic images. However, because monitor resolution is much less than that of laser jet printers, the monitor can only approximate the final output quality.